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RUBBER AGE

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The Effect of Low Polymerization Temperatures on Some Properties of GR-S Vulcanizates

By L. H. HOWLAND, W. E. MESSER, V. C. NEKLUTIN and V. S. CHAMBERS

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THE temperature of the reacting system is but one of many variables present in the emulsion polymerization of diene hydrocarbons and similar materials. All of these variables have been explored to a greater or less extent in the intensive efforts made in the last seven or eight years to obtain a superior synthetic rubber.

It has been known for some time that lowering the temperature of the polymerizing system in which GR-S is made was accompanied by an improvement in the quality of the resulting polymer. In some of the early reports to the Office of Rubber Reserve, it has been pointed out that an increase in the tensile strength of the tread-type vulcanizates could be obtained by this means *(11, 25)*. An increase in modifier efficiency was also found. The polymerization formulas used at these lower temperatures (5° and 12°C) in the early work were the standard GR-S or Type 1 formula and a modification of that reported by Fryling *(5)* and later patented by Stewart and Zwicker *(37)*. The latter formula involved the use of hydrogen peroxide and iron and cobalt salts as the catalyst-system and is referred to here as Type H formula.

Other laboratories at first did not find these improvements but set a maximum temperature of about 60°C as the limit above which serious loss in quality occurred. Messer and Howland *(26)* later reported that polymerizations at 15°C gave polymers with considerably better tensiles and elongations than those at 30° or 45°C. Swaney and Baldwin *(38)* studied the effect of the temperature of polymerization on the properties of unmodified polymer. They found that temperatures down to 15°C gave a polymer with lower amounts of a more diffuse gel which gave a vulcanizate with improved tensile strength.

Two summary reports *(8, 12)* issued in 1943 point out that lowering the polymerization temperature increased the molecular weight and decreased the tendency for gel formation. Improvement was found in processability, in tensile and elongation, and in resistance to tear, cut growth, and abrasion. Several reports in 1944 *(7, 9, 19, 24, 39)* gave the results of polymerizations at temperatures down to 16°C. In some of these experiments, potassium ferricyanide replaced all or part of the potassium persulfate used in the standard formula.

In every case at least some improvement in the tensile of the tread-type vulcanizate was found; while in some, marked improvement in tensile was found along with better resistance to flex crack growth and improved processability as compared to standard GR-S. Brooks, North and Meyer *(2)* found that GR-S made at 7°C had better rugosity *(29)* and gave tread-type vulcanizates that had much better room temperature and hot tensiles, lower hysteresis and greater resistance to flex crack growth than did standard polymer. A type of catalyst first described by Reynolds *(34)* for polymerizations at 50°C was adapted by Kolthoff *(17)* for use at lower temperatures of polymerization. This system was sufficiently promising so that it was studied extensively by Piltz of the Government Laboratories at Akron *(32)* as well as by Schulze *(36)*, by Brown and Johnson *(3)*, and by Perrault et al *(31)*.

The introduction of the German Redox formula *(21, 22)* at the end of 1945 resulted in greatly increased interest in polymerization at low temperatures. By the first of the following year Hobson, Clowney, and Lawrence *(10)* and Johnson, Buskey, and Bebb *(15)* had described formulas that were practical at 10°-15°C and gave a polymer whose tread-type vulcanizates showed improved tensile. Several others were also working with this formula *(23)*.

At about this time cumene hydroperoxide was announced as a new chemical *(4)* and Kolthoff *(18)* soon had devised a formula using this oil soluble oxidizing agent. Cumene hydroperoxide proved to be easier and safer to handle and cheaper than benzoyl peroxide which had been employed as an oil-soluble catalyst in the German Redox formula. Schulze *(35)* reported on its use late in 1946. Since then the interest in both

NOTE: This paper was presented before the Division of Rubber Chemistry at the 113th Meeting of the American Chemical Society, Chicago, Ill.

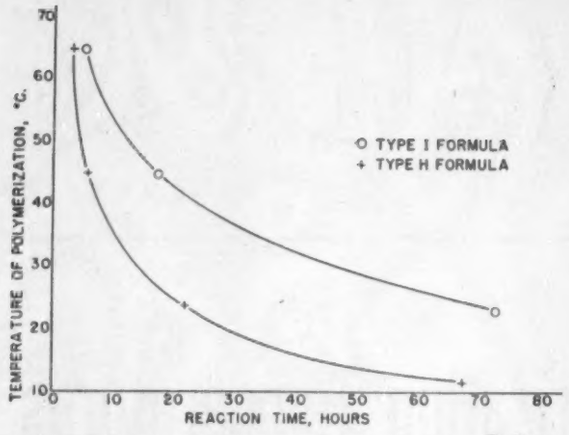

FIG. 1—Effect of temperature of polymerization on the time for reaction to approximately 75% conversion.

types of Redox formula has been extensive as is indicated by the large number of reports to the Office of Rubber Reserve. During this period the temperature of polymerization has been lowered from just above 0°C. to —18°C. while the reaction rate has been kept well within practical limits. Also, polymerizations as low as —40°C have been carried out *(16)* but the reaction times were quite long (96 hrs.) compared to present standards. Of course, antifreezes have been employed in the subfreezing emulsion polymerizations.

Low temperature polymerization was finally carried to plant scale in June, 1946 *(41)* and the polymers X-383, X-384 and X-398 *(13)* were made at 2°C. Since then two other plants have started producing the polymers X-432 and X-435 *(14)* at low temperature (5°C.).

Description of Polymerization Formulas

Four different types of catalyst systems were employed in making the copolymers of butadiene and styrene used in this study. The polymerization formulas are designated as Type 1, Type H, Type R and Type R-C. The Type 1 recipe is very similar to the Mutual recipe used in the large scale production of GR-S and requires the use of potassium persulfate. The Type H formula has been described in the preceding section. In the Type R formula, benzoyl peroxide is the catalyst and in the Type R-C, cumene hydroperoxide is used. The last two formulas are our modifications of the Redox formulas described by the Germans. It is possible to consider the persulfate-mercaptan system of the Type 1 formula and the hydrogen peroxide-iron-cobalt-pyrophosphate complex of the Type H formula as Redox systems in that in both, the reaction of a reducing agent and an oxidizing agent produces a free radical that initiates polymerization.

The Type H formula was considerably faster at lower temperatures than was the Type 1 formula. Examples of the rates found are shown in Figure 1. The Type H and Type 1 formulas were used in the early work to study the effect of low temperatures of polymerization on polymer properties. They became very slow in polymerization rate, however, at temperatures approaching 0°C. As a consequence the early work was not done at temperatures lower than 10°C. Type R and Type R-C formulas are so much faster that a polymerization rate at 2°C can be obtained that is too fast to allow proper heat dissipation in the plant reactors. Conditions have been adjusted so that a 60% conversion is reached in about 16 hours. It was feasible, therefore, to carry the study of the effect of temperature on polymer quality to lower temperature levels than with the original formulas.

In the early work on GR-S polymerization at 50°C a conversion of 70-75% was chosen as the most satisfactory. In view of this, the Type 1 and Type H formulas at low temperatures were carried to the same conversions. In the more recent work employing the Redox formulas a 60% conversion has been selected as that which would give the best all around properties. However, conversion studies of low temperature copolymers are still in progress and further work will be necessary to determine if the best selection has been made. The lower polymerization temperatures (5°C and below) result in lower modifier requirements and a Mooney viscosity of the copolymer that is more sensitive to changes in modifier concentration. It has also been found that as the temperature of polymerization is lowered the tendency for gel formation is reduced and the gel that is formed has a higher swelling index *(1)* and is more easily dispersed on milling. In unmodified runs made at 2°C, gel does not appear until about 40% conversion has been reached while in a Type 1 recipe at 50°C with little or no modifier, gel is present at conversions near 5 per cent.

The early data presented here for polymers prepared in the Type H and Type 1 formulas were obtained with material made in small reactors in the research laboratory. The data are averages of three cures in each of numerous determinations. The polymers X-432 *(14)* and J-889 were prepared with 71-29 butadiene-styrene monomer charge ratio in the Type R-C formula in the internally agitated pilot plant reactors with capacities of 5 gallons or larger. X-383, X-384, and X-398 are polymers which were made in 3500 gallon plant reactors and employed a 71-29 butadiene-styrene monomer charge ratio and cumene hydroperoxide activation at 2°C *(13)*. Potassium oleate was used as an emulsifier and in the case of X-383 and X-384, glycol was used as an antifreeze. X-432 is similar to X-398 except that a rosin soap was used in place of potassium oleate and the polymerization temperature was 5°C. The polymers prepared at —18°C (J-889) were made with potassium oleate as the emulsifier, cumene hydroperoxide as the activator, and an anti-freeze in the aqueous phase. The Mooney viscosities of the copolymers are given in the accompanying tables.

Test Methods

The physical tests used in the laboratory evaluation work fall into six main categories: (a) stress-strain, (b) flexing, (c) hysteresis, (d) resilience, (e) low temperature properties, and (f) processability. The

TABLE I—COMPOUNDING FORMULAS

Formula	A	B	C	D	E	F
Polymer	100	100	100	100	100	100
Channel Black	50	50	20	50	—	50
F. F. Black	—	—	—	—	55	—
Zinc Oxide	5.0	5.0	5.0	3.0	3.0	5.0
Softener	5.0	5.0	5.0	6.0	6.0	5.0
Sulfur	2.0	2.0	2.0	2.0	2.0	2.0
Mercaptobenzothiazole	1.5	1.5	1.5	1.0	0.6	1.2
Diphenylguanidine	—	0.2	—	0.3	0.2	0.1
Stearic Acid	—	1.5	—	1.0	1.0	—
Antioxidant	—	—	—	0.35	0.35	—

tread-type recipes that were used are given in parts by weight in Table I. Formula A is the one used for most of the copolymers, formula B for the copolymers made with rosin soap in place of fatty acid soap, formula C for the 20 of carbon black stocks, and formulas D and E for the stocks mixed in a size B Banbury. X-384 was the only copolymer that had been heat softened.

Stress-Strain: Stress-strain properties were determined with the standard dumb-bell specimens on a Scott tensile machine. A tester fitted with a thermostatically controlled hot water bath was used to make the measurements at 205°F. The aged samples were placed in a hot air oven held at 212°F for the indicated period of time prior to testing.

Flexing: The cut growth was measured by flexing a 0.5x3x0.38 inch specimen that had a circular groove across its width. The sample was bent through a 55° arc at 350 cycles per minute *(40)*. A very small nick was placed in the center of the groove to start cut growth; results are given in thousandths of an inch of growth per kilocycle.

Hysteresis: Hysteresis measurements were made on the torsional hysterometer *(28)*. Values for hysteresis are reported as a logarithmic decrement, K, which is proportional to the fractional energy loss per cycle of damped oscillation when the fractional energy loss per cycle is small. The hysteresis temperature rise is given as the increase in temperature in °F reached in 25 minutes, above 100°F, using the Goodrich flexometer *(20)* with a load of 150 psi, a 0.125 inch stroke, and a speed of 1800 RPM.

Resilience: The resilience was measured on a Bashore resiliometer *(33)* and is reported as the per cent rebound. The low temperature resiliences were measured on samples that had been cooled in a dry-ice-methanol bath to the desired temperature. Since the measurement of resilience can be completed in less than 0.2 minutes and since it has been found that the temperature of the surface of the sample rises from —60°C to less than —58°C in that time when exposed to room temperatures no precautions were taken to keep the sample cold during the determination.

Low Temperature Properties: The behavior of the vulcanizates at low temperatures down to —70°C was measured by means of the resilience test as mentioned above and by the T-50 test *(6)*. The T-20, T-50 and T-80 values are the temperatures at which the specimens had retracted 20%, 50% and 80% of the original 350% elongation.

Abrasion: Several laboratory tests are available for testing the abrasion resistance of a tread-type rubber vulcanizate but in the opinion of the authors none of them gives satisfactory correlation with service conditions. We have based our conclusions of abrasion resistance on the results of tire tests carried out by several agencies.

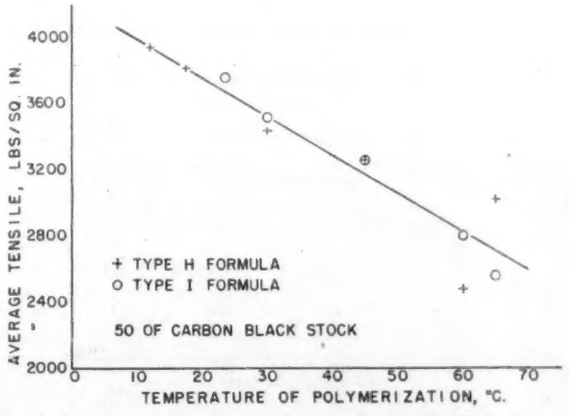

FIG. 2—Relation of temperature of polymerization to tensile at break. (50 of carbon black stock).

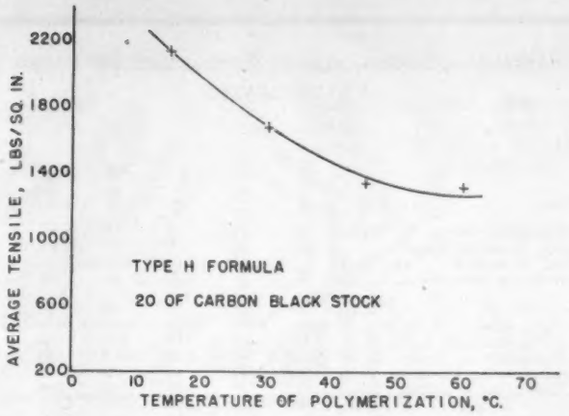

FIG. 3—Relation of temperature of polymerization to tensile at break. (20 of carbon black stock).

Processability: Plasticity was measured by the Mooney rotary disk plastometer *(27)*. All Mooney viscosity measurements were made at 212°F with the large rotor on the raw and compounded polymer. The tubing rate and per cent swelling were measured on the compounded polymers by means of the Royle laboratory tuber *(30)*. The tubing rates are expressed as grams per minute and the per cent swelling as the increase in thickness of the extruded material over the dimensions of the Garvey die. The calender shrinkage is the per cent decrease in length of a calendered sheet after it is removed from the calender rolls *(42)*.

Evaluation of Copolymers as Tire Tread Rubbers

Stress-Strain: Figures 2 and 3 summarize the data obtained with the vulcanizates of the copolymers prepared in the Type H and Type 1 formulas and show the relation between polymerization temperature and tensile at break. The graphs indicate that as the polymerization temperature is lowered the tensiles of both 50 of carbon black and 20 of carbon black stocks increase to a decided degree. A representative set of data obtained with the vulcanizates of the copolymers prepared in the Type R-C formula is given in Table II. The effect of polymerization temperatures near 0°C is obtained by comparing X-432 with GR-S-10 and X-398 with standard GR-S, and the effect of a temperature of —18°C is obtained by comparing J-889 with standard GR-S.

The data in the first six columns of Table II shows that in a modified WPB tread formula the X-432 vulcanizate has a 29% better unaged tensile, 18% better aged tensile, and 53% better hot tensile when compared to GR-S-10. On the same basis X-398 has 11% better unaged tensile, 13% better aged tensile and 20% better hot tensile than GR-S, and the copolymer prepared at —18°C (J-889) to a normal Mooney viscosity has 15% better unaged tensile, 10% better aged tensile, and 15% better hot tensile than the GR-S tested with it. The comparison is on the basis of stocks having 300% moduli of about 1000 psi. The preliminary evaluation of these low temperature polymers had shown that their behavior on curing was different than that of GR-S or GR-S-10.

TABLE II—STRESS-STRAIN PROPERTIES OF TREAD VULCANIZATES

Polymer	X-432†	GR-S-10	X-398	GR-S	J-889	GR-S
Polymerization temp., °C.	5	50	2	50	—18	50
Mooney viscosity, uncpd.	53	43	71	53	74	49
Method of mixing	On a 6 x 12 inch mill					
Compounding formula	B	B	A	A	A	A
Cure at 292°F.	30	30	30	30	30	30
Unaged tensile, lb./sq.in	3030	1650	3320	2480	3580	2340
300% Modulus, lb./sq.in	530	390	480	440	630	520
Elongation at break, %	915	833	920	870	864	893
Aged tensile, lb./sq.in.	2750*	2240*	2740	2500	2940	2750
Elongation at break, %	395	320	455	380	386	376
Tensile at 205°F., lb./sq.in.	1580	530	1950	1280	2310	1350
Elongation at break, %	880	520	856	683	874	680
Cure at 292°F.	60	60	60	60	60	60
Unaged tensile, lb./sq.in.	3570	2670	3460	3130	3710	3240
300% Modulus, lb./sq.in.	930	860	890	930	1150	1040
Elongation at break, %	725	660	670	685	667	650
Aged tensile, lb./sq.in.	2510*	1870*	2600	2310	2770	2530
Elongation at break, %	290	226	386	320	336	310
Tensile at 205°F., lb./sq.in.	1620	980	1680	1400	1850	1600
Elongation at break, %	513	363	510	446	479	445
Cure at 292°F.	90	90	90	90	90	90
Unaged tensile, lb./sq.in.	3360	2610	3200	3130	3750	3480
300% Modulus, lb./sq.in.	1120	1150	1230	1180	1410	1380
Elongation at break, %	640	536	590	595	594	600
Aged tensile, lb./sq.in.	2510*	2130*	2540	2330	2910	2510
Elongation at break, %	295	265	383	355	362	310
Tensile at 205°F., lb./sq.in.	1530	1000	1290	1430	1630	1400
Elongation at break, %	420	316	363	373	395	320

Polymer	X-432†	X-432†	GR-S-10	X-398	J-889	J-889	GR-S
Polymerization temp., °C.	5	5	50	2	—18	—18	50
Mooney viscosity, uncpd.	56	56	50	67	64	84	49
Method of mixing	Size B Banbury			On a 6 x 12 inch mill			
Compounding formula	D	E	D	F	F	F	F
Cure at 292°F.	30	30	30	30	30	30	30
Unaged tensile, lb./sq.in.	3610	3000	2230	4300	4070	4200	3040
300% Modulus, lb./sq.in.	820	980	880	500	700	690	570
Elongation at break, %	770	600	620	810	770	795	760
Aged tensile, lb./sq.in.	—	—	—	2620	2940	3130	2375
Elongation at break, %	—	—	—	425	380	395	325
Tensile at 205°F., lb./sq.in.	—	—	—	2350	2170	2100	1420
Elongation at break, %	—	—	—	890	840	823	663
Cure at 292°F.	45	45	45	60	60	60	60
Unaged tensile, lb./sq.in.	3730	3690	2530	4090	4140	4200	3200
300% Modulus, lb./sq.in.	1080	1330	1040	1000	1170	1200	1100
Elongation at break, %	680	620	580	645	630	610	560
Aged tensile, lb./sq.in.	—	—	—	2675	2800	2700	2325
Elongation at break, %	—	—	—	355	325	340	280
Tensile at 205°F., lb./sq.in.	—	—	—	1770	1720	1790	1400
Elongation at break, %	—	—	—	490	480	475	386
Cure at 292°F.	90	90	90	90	90	90	90
Unaged tensile, lb./sq.in.	4130	3900	2910	4160	4130	4490	3590
300% Modulus, lb./sq.in.	1370	1750	1430	1270	1410	1400	1400
Elongation at break, %	620	540	520	590	580	590	525
Aged tensile, lb./sq. in.	—	—	—	2770	3000	3120	2470
Elongation at break, %	—	—	—	385	375	370	305
Tensile at 205°F., lb./sq.in.	—	—	—	1560	1310	1740	1320
Elongation at break, %	—	—	—	370	353	440	326

* Aged 96 hours at 212° F.; all others for 48 hours.
† Data on copolymer made in the pilot plant.

Modifications of the processing technique and the compounding formulas have given the results listed in the last seven columns of Table II. Here we have obtained some improvement in the properties of GR-S and GR-S-10 as was expected, but a much greater improvement in properties of the vulcanizates of the polymers made at low temperatures. The stock prepared from X-432 in a Banbury showed a 45% advantage in unaged tensile over the GR-S-10 control. The copolymers made on fatty acid soap at 2°C (X-398) and at —18°C (J-889) showed marked improvement over GR-S. The unaged tensile of the vulcanizate from X-398 was 28% better than the unaged tensile of the standard GR-S stock, the aged tensile was 15% better and the hot tensile was 26% better. The unaged tensiles of the two J-889 stocks were 29% and 31% better than that of the GR-S standard, the aged tensiles were 20% and 16% better and the hot tensiles 23% and 28% better.

In view of the fact that these low temperature polymers seem to break down more easily, it is of interest to compare tensiles of the tread vulcanizates with the Mooney viscosities of the raw polymers. In Figure 4 these two properties are compared for a series of polymers made in the Type R-C polymerization formula at 2° to 5°C and a series made in the Type 1 formula at 50°C. The data indicate that with low temperature polymers the tensile increases as the raw Mooney viscosity increases up to 200 while the polymers prepared at 50°C give tread vulcanizates that show an initial increase in tensile as raw Mooney increases above 50 followed by a marked decrease to very low tensiles for polymers with Mooney viscosities approaching 200.

Flex Crack Growth: The flex crack growth of X-398, X-432 and a polymer prepared at —18°C (J-889) is presented in Table III. The values compared are for samples with approximately the same 300% modulus and similar hysteresis heat rise. On this basis the flex crack growth of unaged X-432 is about one-fifth of GR-S-10 and about one-third after aging 96 hours at 212°F. In the case of X-398 the flex crack growth of the unaged sample is about one-half that of GR-S while the growth of the aged sample is about two-fifths the growth of GR-S. The flex crack growth of the unaged sample of J-889 is one-ninth that of the standard GR-S control. These results show that an appreciable improvement in resistance to flex crack growth is obtained by lowering the temperature of polymerization but a considerable amount of further testing must be done to establish the degree of superiority with any degree of exactness.

It should be emphasized that the flex crack growth test employed here is actually a test of the rate of growth of a pre-formed crack. The test specimen is nicked with a razor blade before flexing is started. The spread between the cracking results of the vulcanizates of the low and high temperature copolymers would probably have been much greater if the crack had not been initiated by cutting.

Torsional Hysteresis: The torsional hysteresis as measured by the Mooney hysterometer appears in some determinations to be somewhat lower for an X-432 stock than for GR-S-10 stock (0.146 vs. 0.190 and 0.199 vs. 0.220) while in others it is about the same (0.202 vs. 0.202). These values are for cures having about the same moduli. However the weight of the evidence so far

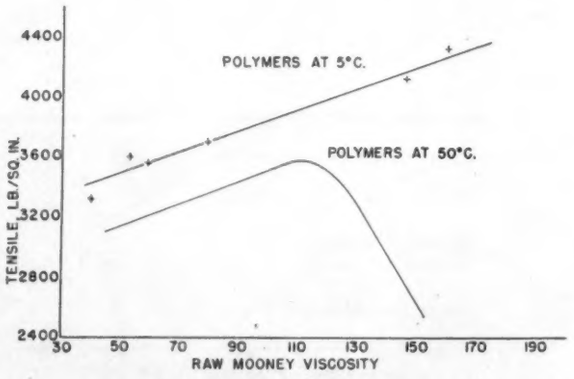

FIG. 4—Effect of the Mooney viscosity of the raw copolymer on the tensiles of the tread vulcanizates.

obtained indicates that the torsional hysteresis for X-432 is somewhat less than that for GR-S-10. In the case of X-398 the available hysteresis data (2 experiments) are insufficient for a definite conclusion.

Resilience: The per cent rebound at room temperature and at 100°C for vulcanizates of X-432, GR-S-10, X-398, J-889, GR-S, X-383-4, X-384 and J-694 are given in Table IV. Copolymer, X-383-4, is one batch of the X-383 prepared at Institute and J-694 is part of the production of X-384 before it was latex heat softened. The copolymers were compounded in the tread formula A of Table I and the values given are the averages of several determinations. Polymerization at 5°C with rosin soap yielded a polymer, X-432, that gave a vulcanizate with a slightly higher resilience at room temperature and at 100°C than did GR-S-10. In the case of X-398 and J-889, polymers prepared with fatty acid, no appreciable improvement over corresponding GR-S compounds was found at room temperatures but the rebound at 100°C was noticeably better.

The German workers reported that their polymers prepared at low temperatures in the Redox systems had a higher resilience than did their standard Buna S. This may be explained by the fact that the Germans employed an unmodified Redox formula and a Buna S formula that gave a high Mooney partially modified polymer which was then heat softened. Our results with high Mooney polymers confirm this as X-383-4 and J-694 gave stocks with higher rebounds than GR-S stocks and this improvement is preserved to some extent even after heat softening to the low Mooney viscosity of 30.

Low Temperature Properties: The resilience of X-398, X-432, GR-S, and GR-S-10 in tread-type vulcanizates has been measured between —60°C and room temperature. Figure 5 shows that the type of emulsifier governs the temperature at which the polymer loses its elastomeric rebound and begins to behave as a solid such as steel or glass. X-432 and GR-S-10 reach this minimum resilience at —20°C while X-398 and GR-S do not reach a minimum until —30°C. The test measures the way in which the recovery of the polymer from rapid and small deformations changes with the temperature and shows that the polymers prepared at low temperatures of polymerization behave in about the same way as their counterparts made at 50°C.

The T-50 test was run on vulcanizates of the same polymers as mentioned in the preceding paragraph. In Figure 6 the per cent retraction from 350% elongation is plotted against the temperatures. In the lower temperature range X-398, GR-S, and GR-S-10 retracted about the same amount at each temperature while X-432 was slower to retract, that is, it was stiffer. At a temperature of about —35°C, X-393 began to show a superiority over the other three materials as it retracted to a greater extent. This behavior can be summarized by comparing the temperatures at which 20%, 50%, and 80% retraction had occurred.

Abrasion: A number of tires with treads made from 2°C and 5°C copolymers have been evaluated for road wear and an additional number of tests are now in progress. Most of the preliminary results have shown the low temperature copolymers to give treads with considerably better wear resistance than corresponding GR-S treads and a number of tests have shown treads from low temperature copolymers to be equal to natural rubber treads and some have shown them to be superior to the latter. In fact, treads from low temperature polymer with one of the best reinforcing furnace blacks have shown wear resistance approximately 30% better than a natural rubber tread.

Processability: Table V presents some processing characteristics of the stocks compounded in Formulas A and B of Table I. The low temperature copolymers

TABLE IV—RESILIENCE OF TREAD VULCANIZATES

Polymer	Pzn. Temp., °C.	Mooney Visc., Uncpd.	Rebound at 22°C.	Rebound at 100°C.
X-432*	5	53	39	46
GR-S-10	50	50	35	43
X-398	2	60	42	52
J-889	—18	74	41	50
GR-S	50	50	41	48
X-383-4	2	117	45	55
J-694	2	146	45	58
X-384	2	30	44	49

* Data on copolymer made in the pilot plant.

TABLE III—FLEXING PROPERTIES OF TREAD VULCANIZATES

Copolymer	Pzn. Temp., °C.	Unaged Flex Crack Growth, .001 in/Kc	Aged Flex Crack Growth,* .001 in/Kc	Unaged 300% Modulus lb./sq.in.	Heat Build Up, °F
X-432†	5	0.2	1.4	1120	65
GR-S-10	50	1.1	4.2	1150	65
X-398	2	0.6	2.2	930	69
GR-S	50	1.1	5.6	960	75
J-889	—18	0.2	—	1130	72
GR-S	50	1.8	—	1130	81

* Aged 96 hours at 212°F.
† Data on copolymer made in the pilot plant.

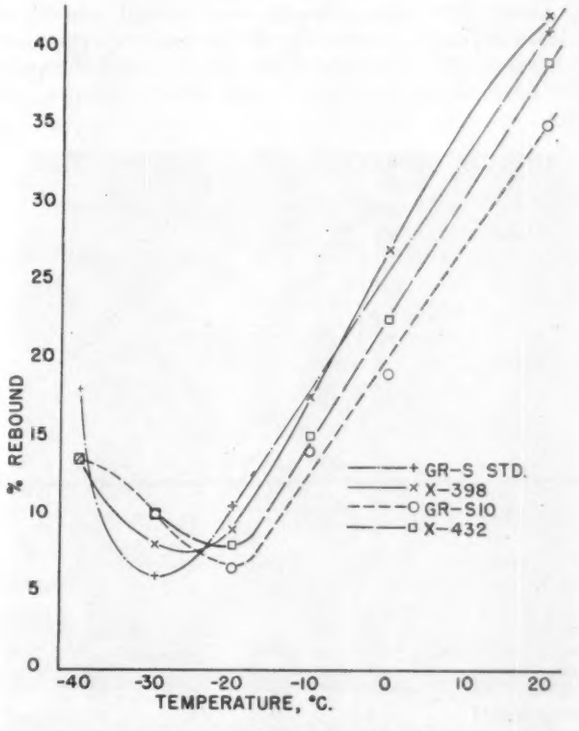

FIG. 5—Resilience of tread vulcanizates at subzero temperatures.

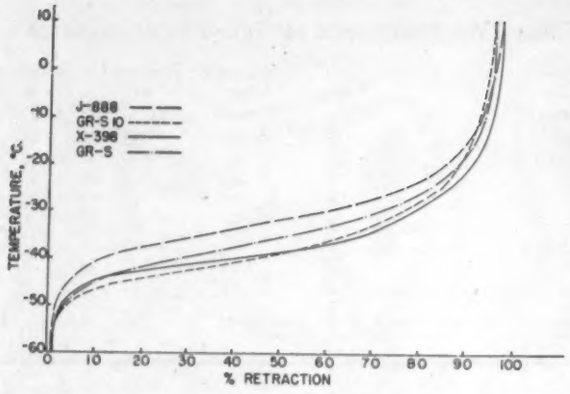

FIG. 6—Retraction of tread vulcanizates at sub-zero temperatures.

are better than, or equal to, the corresponding 50°C copolymers in tubing rate, per cent swelling at the Garvey die, and calender shrinkage.

Summary

Copolymers of butadiene and styrene with a 71/29 monomer charge ratio have been prepared at 5°C, 2°C, and —18°C and have been compounded in tread recipes. Evaluation tests have shown that lower temperatures of polymerization result in marked improvement in the vulcanizates of the resulting copolymers.

1. An improvement in the stress-strain properties (tensile at break) up to 30% or better can be expected when GR-S or GR-S-10 is replaced by copolymers prepared at low temperatures.

2. A two to nine fold improvement in resistance to flex crack growth has been obtained with the vulcanizates of the low temperature copolymers in comparison to those of standard GR-S or GR-S-10.

3. Tread wear rating based on a limited number of tire tests indicates a definite and marked superiority of low temperature copolymers over GR-S and the probability of a rating equal to or better than natural rubber treads.

ACKNOWLEDGMENTS

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TABLE V—PROCESSABILITY OF TREAD STOCKS

Copolymer	X-432*	GR-S-10	X-398	J-889	GR-S
Temp. of pzn., °C.	5	50	2	—18	50
Tubing rate, gm./min.	67	65	71	73	70
Swelling, %	30	41	39	33	42
Calender Shrinkage, %	31	48	37	32	47
Mooney viscosity					
Uncompounded	53	48	66	64	51
Compounded	62	59	78	81	62

* Data on copolymer made in the pilot plant.

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Advances in Rubber During 1947-48

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THE past year* has seen a number of advances in the field of rubber, at least one of which may prove to be of real significance in the years ahead. To measure better such achievement, it would be well to look briefly into the past. After Charles Goodyear discovered vulcanization in 1839, progress in rubber technology was quite leisurely until the beginning of this century. In 1906 George Oenslager discovered the accelerating effect of aniline, the first organic accelerator. This spectacular advance was followed by the discovery of rubber reinforcement by carbon black, providing much improved wearing qualities for tires. Although the Germans produced and used dimethylbutadiene polymers during the first World War, it was not until neoprene and Thiokol were introduced in the early thirties that the rubber manufacturer had more than one basic elastomeric substance for his commercial operations. During that same period, the commercial large-scale development of natural rubber latex became a reality.

The chemical engineering achievement of designing and building facilities to produce nearly a million tons of GR-S a year is well known. Although progress in the quality and use of GR-S was rapid, it appeared that the natural product would still hold preference as a general purpose rubber following the end of the war. However, the past year has seen the initiation of the first real commercial threat to the dominance of natural rubber. "Low temperature" rubber, especially in conjunction with the new furnace carbon blacks, may mark a new milestone in the progress of rubber technology.

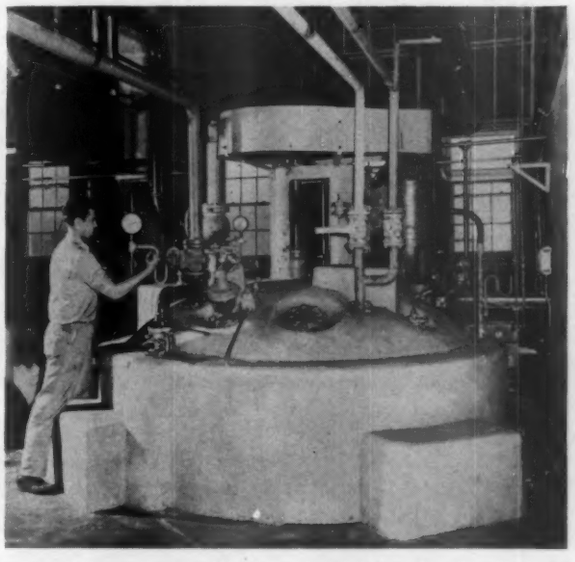
Although much of the basic work was done before 1947 and pilot plant operations had been started in 1946, the first plant scale runs of low temperature rubber were made at the Institute, W. Va., copolymer plant by the United States Rubber Company in the summer of 1947. The next important move was the granting of permission by the Office of Rubber Reserve to Copolymer Corporation in October, 1947, to convert one-half of its annually rated capacity of 30,000 long tons of GR-S to the production of 41°F. rubber. Recent authorizations will convert about half of the existing active and profitable GR-S plants to this type of operation with a productive capacity of 183,000 long tons per year.

New Developments and Processes

Elastomer Developments: A detailed account *(1)* of GR-S polymerized at low temperatures covers the development, pilot plant and large scale production of this new polymer, describes the physical properties of the rubber, and points out possible future work. This report, which is built around a specific plant installation, cites 47 references in the literature. A pilot plant for making low temperature rubber *(2)* was designed in 1942 following methods suggested or developed in this country and in Germany. Low temperature polymerization as developed by the Phillips Petroleum Company *(3)* has given rubber with good abrasion resistance without sacrificing resistance to cracking and cut-growth. Although standard channel or furnace black reinforcement gives excellent hysteresis-flex-life, high abrasion furnace blacks give in addition unexpected improvement in tread wear.

The effect of polymerization temperatures below 30°C. has been studied *(4)* and it was found that GR-S produced at temperatures as low as 10°C. processed better and yielded vulcanizates with superior stress-strain properties and more resistance to flex-crack growth, tear and abrasion than standard GR-S produced at 50°C. The early formulae resulted in long reaction times, but more recently faster recipes have permitted polymerization to occur with normal rates even at sub-freezing temperatures.

The development and availability of over 400 experimental and general purpose GR-S polymers has been discussed *(5)*, pointing out how these polymers came into being and what advantages they offer. Of the 411 experimental GR-S polymers scheduled up to October, 1947, 28 have been transferred into the numbered GR-S classification, such as GR-S-10 and GR-S-50. This and the fact that Standard GR-S represents less than 50% of government synthetic rubber production focuses attention on the fact that GR-S is a family of styrene copolymers, practically always with butadiene although with isoprene in some cases. Monthly listings in the rubber trade journals of experimental GR-S polymers brings the total up to 460 at the end of the period under review. These newer types include low temperature



Typical of low temperature polymerization equipment is this insulated 3,750-gallon reactor used by U. S. Rubber at the Borger, Texas, plant.

Note: This report was presented before the Rubber and Plastics Division of the American Society of Mechanical Engineers on November 30, 1948, in New York City.

* In accordance with the policy of A.S.M.E. which aims to have future papers of this nature cover the literature from June of one year through the following June, the present report begins where "Advances in Rubber in 1947" ended, *viz.*, October, 1947, and continues through June, 1948.

rubber, variations in previous GR-S polymers, and new developments in latex-compounded black masterbatches.

Thiokol LP-2, a polyfunctional mercaptan, is a polymer manufactured in a liquid state and can be converted by catalysts to a tough rubber without appreciable shrinkage *(6)*. LP-2 remains flexible at —65°F. and has been recommended for service temperatures up to 250°F.; it can be applied as a liquid in places difficultly accessible for a solid rubber-like material and then cured *in situ* to a solid. Thiokol PR-1 *(7)* is classified as a tailor-made polysulfide type rubber with good dimensional stability in aromatic and non-aromatic fuels, as well as many other commonly known and used solvents. This material has good low temperature flexibility and resistance to compression set and aging.

Improved formulations consisting of highly plasticized, high molecular weight Butyl rubber have been studied and correlations established between the performance and physical characteristics such as rebound, rate of retraction, modulus, and viscosity of the softener used *(8)*. Another approach involves increasing the unsaturation so that the polymer may be brought to a higher state of vulcanization. Compounding studies including both acceleration and filler-addition are being made to improve Butyl for low temperature service.

Copolymers of butadiene with 2-vinyl furane, 2-vinyl thiophene, methacrylonitrile and vinylidene chloride have been prepared and described *(9)*. The quality of copolymers from 2-vinyl thiophene and methacrylonitrile compares favorably with that of GR-S. Copolymers of dienes with substituted vinyl pyridines have shown promise as synthetic elastomers yielding vulcanizates with high modulus, high tensile strength and superior flexing-hysteresis balance *(10)*. In the quest for rubber hydrocarbon sources during the war, attention was given to rubber-bearing plants other than *Hevea brasiliensis* *(11-15)*. One of these studies implied that none of these lesser known plants can become a serious competitor to *Hevea brasiliensis*.

Under certain conditions linear rubbery polymers are produced by the condensation of a dibasic acid and glycol or diamine *(16)*. One of these, a diisocyanate-modified polyester amide (Vulcaprene A), is compatible with nitrocellulose, polyvinyl formal, cellulose acetate, degraded vegetable tanned leather, and other high polymeric materials. Such combinations find utility as coatings and leather substitutes. There has been a review covering chlorinated rubber, rubber hydrochloride, cyclorubber, oxidized rubber, hydrogenated rubber and thermoplastic molding resins formed by reacting rubber with substances like phenol, maleic anhydride, aldehydes, peracids, etc. *(17)*. The preparation and properties of a typical commercial cyclorubber have been given together with its application in coatings, hot melts, lacquers, electrical insulation, inks and adhesives *(18)*.

Basic reactions occurring during rubber reclaiming have been studied with reference to the influence of reclaiming media, antioxidant and defibering agents at 195 psi steam pressure *(19)*. A review has been presented of the transition in reclaimed rubber from a straight natural rubber base to a combination of natural rubber and GR-S and comparisons are made between pre-war and present types *(20)*. Physical data for tire, mat, black heel, and hard rubber battery container stocks indicate that replacement of pre-war reclaims with present grades can be made without sacrificing quality and with the advantage of improved processing.

Polymerization: A comparison of the properties of polybutadiene, methylated polybutadiene, and copolymers of butadiene with various vinyl monomers has been made *(21)*. The effect of methyl groups and other substituent groups on the properties of straight-chain polybutadienes is discussed. The greater the number of substituents, the poorer are the freeze properties of the polymers. The effect of substitution on the reactivity of the styrene double bond towards free radical attack has been studied with reference to copolymerization *(22, 23)*.

The effect of different peroxides as catalysts and different polyhydroxy compounds as reducing activators both in the presence and absence of metals in a redox-activated emulsion copolymerization of butadiene and styrene has been determined *(24)*. The need for careful balance or tuning of any reduction-activation system is emphasized. A redox-activated emulsion polymerization system has been investigated in which benzoyl peroxide, sorbose, and ferrous ammonium sulfate constitute the oxidation-reduction system yielding rapid rates of reaction for low temperature polymerization *(25)*. A redox system consisting of cumene hydroperoxide, a reducing sugar, and iron pyrophosphate has been found to be effective for initiating emulsion polymerization with disproportionated rosin soap emulsifier *(26)*. The copolymerization of butadiene and styrene (GR-S) with this system gave 72% conversion in two hours at 43°C. or in 23 hours at 15°C.

In a study covering polymerization theory, the reduction-activation is described in relation to German redox-formulation *(27)*. A number of additional activator systems for the copolymerization of butadiene and styrene have been studied *(28-33)* and also the inhibiting and retarding effect of certain classes of materials *(34-37)*. Considerable attention has been given to the use of mercaptans and mercaptan derivatives as modifiers for emulsion polymerization of butadiene and styrene *(38-42)*. A comprehensive review has been made covering the part that organic chemistry played in the development of synthetic rubber during the war period *(43)*.

Latex: Since the end of the war the interest in natural rubber latex has been renewed and there are indications that consumption of rubber in this form will expand considerably in the future, particularly for sponge. The market for latex foam in the United States has been discussed *(44)*. A comprehensive review has pointed out what plant and shipping facilities are available for the rehabilitation of latex operations in the Far East and covers the status of natural vs. synthetic latex with production figures and anticipated consumption *(45)*. Quality control on post-war latex has been reviewed *(46)* and a comprehensive study covering our present knowledge of preparing latex for bulk sale has been presented *(47)*.

Work has been done on electrical coagulation *(48)*, continuous coagulation *(49)*, and the use of sulfurous acid as a coagulant *(50)*. Methods of concentrating latex *(51-54)* include the use of electro-decantation, centrifuging and creaming. In order to avoid expensive and time-consuming concentration operations it has been found possible to produce high-solids synthetic rubber latices directly in the reactor *(55)*.

A post-war review of latex processes and its possibilities covers dipping *(56)*, molding and casting *(57)*, and cement-latex operations *(58)*. Particular attention is given to the molding of rubber goods from latex by means of the Kaysam process *(59)*. The saturation and impregnation of paper with latex compound *(60)* and the use of latex containing a positive charge as applied to textile fiber *(61)* have been reviewed.

Vulcanizing, Aging, and Compounding: Studies on the mechanism and theory of vulcanization continue to

absorb the interest of rubber technologists *(62-69)*. Special attention was given to the study of the vulcanization of chlorine-containing acrylic ester elastomers *(70)* and to the application of the Peachey process to the curing of synthetic rubbers *(71)*. The advantages of vulcanizing with thiuram sulfides, which reduce swelling, have been pointed out *(72)*.

The use of accelerators in the last century has been reviewed and brought up to date pointing out the possibilities of fast cures through high-frequency vulcanization *(73)*. In view of the trend towards high-speed Banbury mixing in which high temperatures are generated, a study has been made to determine the effect of such temperature on the activity of a representative group of rubber accelerators *(74)*. It was concluded that all the accelerators tested showed some impairment in strength due to the high processing temperature and that some types lost greatly in accelerating value.

Experiments have been described to show that the combined use of an antioxygenic agent and a deactivating agent make it possible to improve the aging of rubber mixtures to a considerable extent *(75, 76)*. The difference in behavior of these two types of agents is explained by assuming that some agents act not by retarding the rate of oxidation but by deactivating the peroxides as soon as they are formed. This theory is supported in another study *(77)*. A further contribution to the mechanism of oxidation is illustrated by showing possible transformations which each isoprene unit in the rubber molecule may undergo during oxidation *(78)*. It has been found that the profound degradation of rubber by oxygen in the presence of benzoyl peroxide is related to phenomena involving the alpha-methylenic hydrogen of the rubber hydrocarbon *(79)*. Work is described to establish the relative characteristics of various compounding ingredients including antoxidants with respect to their tendency to stain enamel finishes and to discolor light-colored compounds *(80)*. In a search for suitably effective non-discoloring antioxidants, it was revealed that alkyl phenols impart protection to vulcanizates of copolymers of butadiene with styrene and acrylonitrile *(81)*.

Work continued on the fundamental properties of carbon black including surface area measurements *(82)*, heats of adsorption *(83)*, and crystal structure and particle shape *(84)*. Heat treatment of rubber-channel black stocks or treatment with certain chemicals such as benzidine enhance the chain-breakdown during remilling which results in increased electrical resistance *(85)*. A general review of the properties of carbon black in relation to its behavior in rubber has been presented *(86)*. The properties and uses of soft carbon blacks in natural and synthetic rubber stocks have been reviewed *(87)*. Particular attention has been given to the recently introduced fine furnace blacks with some evidence indicating improved reinforcement over other types of black *(88-90)*.

An extensive study has been made covering the activity of rubber fillers and the relation between crystallinity and various physical properties of the rubber compound *(91)*. The mechanism of reinforcement of elastomers by pigments such as calcium carbonate and HMF black has been studied with particular reference to modulus *(92)*. GR-S-10 has been substituted in GR-S test vulcanizates containing various types of pigments and the effect of this substitution on physical properties has been evaluated *(93)*. New fillers for rubber have been disclosed: Teg, a hydroxide gel of aluminum with a particle size of 0.01-1.0 micron *(94)* and Frantex-A, a finely ground hydrated aluminum silicate *(95, 96)*. There have been studies on compounding as it affects oil resistance of natural rubber *(97)* and on the influence of fillers on the properties of natural and synthetic rubbers after swelling *(98)*. Experiments based on rheological phenomena have been described on coarse-grained and fine-grained materials showing the value of this approach as applied to coarse-grained sponges of rubber and how much the sponge can be varied structurally *(99)*.

A comprehensive survey on the technology of color as applied to rubber has been made covering mass pigmentation, lacquers and surface drying processes *(100)*. The influence of accelerators, antioxidants, method of vulcanization, type of mold metal, and the relation between the chemical properties of color and the other ingredients in the rubber mix have been considered.

Mechanism of plasticizer action has been analyzed for linear and slightly and highly-cross-linked polymers with consideration of the flexibility of the polymer chain, polar interaction of groups along the chain, the masking of these interactions by plasticizer molecules, and the importance of the relative shape of polymer unit and plasticizer in effectiveness of separating the chains *(101)*. The miscibility of plasticizers with polymers and the migration of plasticizers have been studied and correlations of physical properties with viscosity of the plasticizer have been set forth *(102)*.

Petroleum products have been given special attention, emphasizing the underlying principles and major operations in their chemical manufacture *(103)*. A German tabular study presents the trade names, manufacturers, chemical formulae, properties and uses of softeners for the rubber industry *(104)*. Recent investigation of immiscible polymeric plasticizers such as polyisobutylene indicates they have excellent processing properties and physical properties comparable to those obtained when using miscible ester plasticizers *(105)*. Work on resinous styrene-butadiene copolymers containing high proportions of styrene has proceeded *(106-108)* and data on blends of these resins with various elastomers have been presented. A water-dispersed form of such a resinous copolymer has been evaluated as an additive to natural and synthetic rubber latices *(109)*.

S-Polymers, new thermoplastic resins, are copolymers of styrene and isobutylene produced by a low temperature technique similar to that used for Butyl rubber *(110)*. These polymers can be used alone as a plastic

Research activities were maintained at high pitch. Here is a view of a section of the new Goodrich Research Center at Brecksville, Ohio.

having rubber-like characteristics such as extensibility and recovery, as a modifying agent for other plastics, or as an additive to natural and synthetic rubbers to improve processibility, increase water vapor and gas barrier properties, and otherwise modify the physical properties.

The practical aspects of compounding with coumarone-indene resin have been given further attention *(111)*. Specifically formulated phenolic resins have two major uses in the rubber industry—rubber compounding and solvent-type adhesives *(112)*. Such resins, which act as thermosetting plasticizers, are completely compatible with the butadiene-acrylonitrile elastomers and impart to such rubbers high tensile strength and hardness; improved resistance to abrasion, solvents, and oils, and excellent surface finishes. A different approach is based on combinations of such modified phenolic resins with butadiene-acrylonitrile rubber to plasticize and modify the resin itself *(113)*. This points the way to many new and improved applications. A detailed German study deals with a number of practical compounding problems including mixtures of synthetic elastomers to give better properties, the effect of softener addition, and the effect of litharge on cure rate *(114)*.

Rubber Fabrication: Recent developments in rubber and plastics machinery have been comprehensively reviewed with particular reference to the two-roll mill, the internal mixer, the continuous screw mixer, calenders and calender auxiliary equipment *(115)*. The extent to which the rubber industry depends upon instrumentation has been discussed pointing out the utility of special devices including electronic control besides the usual plant instrumentation *(116)*. Specific use of electronic control in golf ball winding operations has been reported *(117)*. Of interest to the engineering profession is the study on the design and construction of arc welded steam platens which won an award in a recent Design-for-Progress Award program in the Industry Machinery Division *(118)*.

Modern tire-making methods have been reviewed with a flow sheet covering operations in a specific plant *(119)*. The latest developments in injection molding of rubber goods *(120)* and the application of high-frequency dielectric heating *(121)* have been covered. Special attention has been given to quality control through design of equipment, raw material selection, processes and methods, inspection and testing of finished products *(122)*. Consideration has been given to health protection and safe operating conditions in the rubber industry *(123-128)* covering such subjects as toxicity of materials, ventilation control, isolation of hazardous operations, and fire hazards in cement handling.

Testing: Considerable attention has been given to improving standard tests and techniques for testing rubber and the application of statistical methods in interpreting the results *(129-136)*. More work has been done on the determination of unsaturation of elastomers by halogen reactants *(137-139)*. Perbenzoic acid has been used in the quantitative measurement of internal double bonds *(140)*. Further studies have been made on the molecular weight and structure of rubber polymers *(141-147)*. Crystallization and optical properties of rubber under conditions of stress have been given attention *(148-151)*. An x-ray method has been described for studying the mixing, distribution and size of sulfur and filler particles in rubber mixes *(152)*. New techniques and procedures have been developed for testing latex *(153-158)* including such factors as electrophoretic mobility, strainability, dispersoidal analyses and systematic organic analysis.

A comprehensive study has been made of the testing and grading of wild and plantation rubbers *(159)*. Methods have been proposed for the quantitative determination of the elastomer composition of rubber mixtures *(160, 161)*. A practical method for estimating the amounts of GR-S and natural rubber in reclaims containing these two polymers has been worked out *(162)*. Measurements of elongation of rubber vulcanizates at a fixed stress form the basis of a new strain test of a high degree of accuracy *(163)*. A graphical presentation shows the relationship between Mooney viscosity and Williams plasticity *(164)*, while a new apparatus has been designed for evaluating the moldability of rubber mixtures *(165)*.

A continuation of a study on abrasion covers such subjects as the influence of softeners, the influence of grain in tire treads, the durability of abrasive wheels, the influence of type of abrasive and the value of an abrasive index *(166-170)*. The chief source of error in evaluating the abrasion resistance of GR-S tread compounds was removed when the sample was first extracted with alcohol-toluene azeotrope *(171)*. Recommendations have been made to improve the precision of cut-growth tests for GR-S vulcanizates *(172)*. Research studies aimed at improving and standardizing flex-cracking tests *(173, 174)* discuss types of tests, factors influencing the test, and accuracy of test results. The necessity for improving the degree of uniformity of test specimens is emphasized. Various factors influencing results of hardness tests of vulcanized rubber have been described *(175-180)*.

Surveys have been made on accelerated aging tests *(181, 182)* and the separate evaluation of the effects of water, oxygen, sunlight, and ozone have been correlated for forecasting the behavior of rubber compounds under various weather conditions *(183)*. In order to test rapidly white or light-colored rubber for staining or bleeding characteristics, a new apparatus that permits rapid evaluation has been developed *(184)*. A method has been described for the experimental determination of dynamic viscosities and elasticities and the relaxation of rubber *(185)*. The Roelig hysteresis machine was developed to stimulate more closely the deformations and strains undergone by rubber during its service life than that achieved by conventional types of apparatus *(186)*.

A twin transducer has been developed for measuring the dynamic viscosity and rigidity of rubber-like solids in small oscillating deformations *(187)*. This instrument is said to have two advantages over the usual resonance devices: (a) the amplitudes of motion, which need not be measured directly, are extremely small, thus minimizing any non-linear effects or temperature change due to heat dissipation; (b) a continuous range of frequencies spaced as closely as desired is available without adjusting masses. An acoustical determination provides the necessary relations for computing Young's modulus and the associated viscosity coefficient of the material *(188)*.

The electrical testing of rubber has been given attention in two different studies *(189, 190)*. A burst test apparatus for rubber has been developed *(191)*. A joint project has resulted in an instrument for measuring the slipperiness of walkway surfaces *(192)*. Behavior of rubber at low temperatures has become an increasingly important subject. The complications involved in evaluating behavior of rubber at low temperatures are stressed and the need for standardization has been emphasized *(193)*.

In a contribution on the testing and evaluation of tire cords an attempt has been made to find the causes

of cracks in tire carcasses and details have been given of an apparatus for testing cords for rubbing fatigue *(194)*. Hysteresis, elastic modulus, total growth and growth rate of tire cords have been measured under conditions of rapid cyclic loading *(195)*. Three techniques are reported for estimation of rubber in treated fiber products *(196)*. As an adjunct to normal inspection procedure, an x-ray test is used for examining finished tire quality *(197)*. Utilizing rigid inspection technique, numerous samples of rubber hose have been examined and the types of defects have been classified into major and minor types according to their severity *(198)* and it is recommended that this type of study be extended as soon as possible to other rubber items.

Engineering Properties and Applications

While extensive progress has been made during the past fifteen years by mechanical engineers in becoming acquainted with the engineering properties and uses of rubber in many basic forms, much more could probably be accomplished in this direction. Because of the complexity of elastomeric chemistry and compounding, the technological weight in the rubber industry falls heavily on the side of chemistry rather than engineering. A good deal of data on the physical and mechanical characteristics of rubber are thus channeled in the direction of societies and journals predominantly chemical in nature. Perhaps for this same reason a good deal of data remains unpublished in company files. To meet this deficiency is not an easy problem, but certainly the way is pointed toward closer cooperation between the rubber chemist and engineer and the publication of more data on rubber in engineering journals. This problem has been cited and, as one contribution to meet this end, a summary has been made of recent literature concerning basic engineering properties and applications of rubber, particularly for use in springs and mountings *(199)*. Throughout this study, however, many questions are raised for which the engineer should have an answer.

Properties: There is a new rubber journal which stresses the practical applications of rubber *(200)*. One of a series of manuals on engineering materials deals exclusively with rubber and points out that rubber, unlike steel and metallic materials, is not specified or applied as a standard formulation, as would be an SAE steel. Because rubber compositions are devised to attain the desired application properties, it is important that engineers know what properties can be provided. This manual discusses the basic properties of rubber and how these can be modified *(201)*. With the view of presenting facts that will aid in selecting the best type of rubber for any given service conditions and help in the development of new elastomers, it has been demonstrated that chemical characteristics of a polymer such as molecular chain length, degree of cross-linking and polarity determine (1) mechanical behavior in the unvulcanized and vulcanized state, (2) the ranges of temperature and deformation rate within which the vulcanized material is truly rubber-like, and (3) dissolution and swelling in organic liquids *(202)*.

A program designed to find out how rubber properties differ with the molecular structure of basic elastomers, with the nature and amount of compounding ingredients and with the processing of the compounded mixture has been outlined *(203)*. Factors influencing polymer properties have been discussed with particular reference to monomer constitution, polymerization conditions, copolymerization and cross-linking *(204)*. In an experimental survey of the mechanical-optical properties of materials varying in nature from ideal rubber to polycrystalline plastics, the application of the technique of stress and birefringence for time-dependent behavior of these systems have been considered *(205)*. Mathematical relations have been derived for expressing the elastic optical properties for swollen elastomers in terms of molecular dimensions and positions *(206)*. The swelling action of ethylene glycol on natural rubber, on neoprene and Perbunan vulcanizates has been investigated *(207)*.

Emphasis has been placed on the effect of molecular weight distribution on physical properties of natural and synthetic polymers showing its relationship to processability and polymer quality *(208)*. An evaluation of rubber-like materials has demonstrated that plasticity is a function of the average chain-length of the polymer molecule *(209)*. A study of the thermodynamics of the strained elastomer has given consideration to entropy, energy of deformation and volume as a basis for a general thermodynamic analysis *(210)*. This study has continued dealing with compressibility *(211)*, the thermal coefficient of modulus and statistical theory of elasticity *(212)*. Some of the implications of the classical elasticity theory of infinitesimal deformations and of the more general theory of large elastic deformation of incompressible isotropic materials are related to engineering with vulcanized rubber. Attention is drawn to the desirability of taking these theories into consideration in the design and testing of rubber components *(213)*.

Citing the need of more adequate information about the dynamic characteristics of elastomeric vulcanizates, data have been presented on neoprene vulcanizates in relation to the effect of variations in filler content on such properties as resilience, heat build-up, dynamic modulus and damping *(214)*. The resiliency of a material has been defined as a complex stress-strain-time property, characterizing the completeness of recovery from deformation and varying in kind with the modulus of elasticity and the rate of recovery *(215)*. In dealing with hysteresis in tension tests it has been said that the changes in properties produced by previous thermal and mechanical treatment must be taken into account when considering the suitability of a vulcanizate for a particular application and this memory has been attributed to a breakdown of the stiffening action of the filler *(216)*. This subject has also been treated in another study which demonstrates that the properties of pure

Rehabilitation of plantations was continued throughout the year. In this view natives in Malaya are handling uncured rubber sheets.

vulcanizates are only slightly affected by previous stretching or flexing *(217)*.

Experimental results have substantially verified the theoretical laws of photoelasticity in the range in which crystallization is absent and give qualitative indication of the variations in crystallization outside this range *(218)*. The specific heats of unvulcanized and vulcanized rubbers as a function of their elongation has been measured *(219)*. A comprehensive study has been made of creep, recovery, and permanent set for Hevea rubber and GR-S over a thousand hour period in a range of elongation at 35°C. and significant differences in behavior of the two types of elastomers pointed out *(220)*.

The permanent set of vulcanized rubber containing fillers has been shown to be almost entirely due to the way in which the filler particles are rearranged by stretching and not a property of the rubber molecules *(221)*. Compounding for hardness is stressed in one study and various blends which give a range of hardness are enumerated *(222, 223)*. The creep in shear of neoprene vulcanizates has been studied as a function of vulcanization, preconditioning in shear at elevated temperatures, and composition, with the mechanical properties in both compression and shear also listed *(224)*.

It has been concluded that it is impractical to increase the thermal conductivity of rubber-like polymers themselves but that this could be influenced considerably by the use of various fillers *(225)*. Under conditions of stretch and low temperature, heat conductivity of natural and synthetic rubbers has been determined *(226)*. The dielectric properties of elastomers have been the subject of two investigations *(227, 228)*. Static charges originate on rubber when it is separated from a dissimilar material as it is in milling and other processing and also in various end uses of the rubber articles. The techniques necessary to reduce these charges are presented *(229)*.

A discussion has been given of the influence of compounding ingredients, rate of vulcanization and amount of stretch on the extent of exposure-cracking of natural and synthetic rubbers with particular reference to GR-S *(230)*, while special attention has been given to the discoloration of neoprene vulcanizates by direct sunlight *(231)*. Work has been reported that indicates that the resistance of elastomer compounds to stiffening during prolonged low temperature storage is favored by the use of interpolymers made from monomer mixtures having a relatively large proportion of each component and thus obtaining mutual interference with crystallization, and also by the use of a "tight" cure which probably so impedes the movement of the polymer chain as to make crystallization difficult *(232)*. A study has been made on the effects of prolonged storage in both the vulcanized and unvulcanized states on the physical properties of tire tread stock with results showing that the unvulcanized stock was more stable than the vulcanizate *(233)*.

Thermodynamic considerations have been applied to the permeability to gases and liquids of a wide range of plastic and elastic polymers *(234)*. Work has been aimed at improving the resistance of natural rubber to oils and solvents by the use of phenol-formaldehyde resins and by chemical modifications of the rubber before vulcanization *(235)*. Results on the diffusivity of hydrocarbon gases through synthetic elastomer diaphragms has been presented reporting the relative merits of materials studied *(236)*. Lactoprene EV, an elastomer composed of 95% ethyl acrylate and 5% chloroethylvinyl ether, is similar chemically to polyacrylic Hycar PA and both have such properties as high resistance to deterioration by heat, oil, sunlight *(237)*. Hycar PA also provides resistance to ozone and gas diffusion as well as good flexing life *(238)*. Hycar OR-25 EP (easy-processing) and Hycar OR-25 NS (non-staining) have superior processing characteristics over standard Hycar OR-25. The NS rubber differs from the EP type only in that a non-staining and non-discoloring antioxidant is used *(239)*.

A general comparison of the properties of natural and butadiene-styrene rubbers has been presented with emphasis on the different effects of compounding ingredients on the two types of rubbers *(240)*. One investigation aimed to compare the behavior of natural and synthetic rubber over the whole range of sulfur content from soft rubber to ebonite *(241)*. A comparison of properties of principal commercial types of synthetic rubber with those of natural rubber is one feature of a well-illustrated book in the Commodity Series *(242)*.

In a continuing study on the properties of hard rubber *(243-249)*, such subjects are dealt with as the use of organic accelerators, factors affecting color, influence of method of vulcanization, measurement of plastic yield, effect of light-absorptive pigments on electrical surface deterioration during light exposure, and influence of rubber purification. A compounding study has been directed towards improving compression properties of cellular ebonites derived from nitrile type synthetic rubbers *(250)*. Although GR-S has been fairly successful as a raw material for hard rubber, attention has been centered again on natural rubber with interest in synthetics being maintained only for special uses *(251)*.

Applications: A series of articles has surveyed manufacturers' experience in the use of synthetic rubbers and the economic possibilities of these materials *(252)*, while another study deals with the selection of rubbers for different industrial uses *(253)*. Safety features on a new 50-passenger compartment coach include crash-proof gasoline tanks adapted from the self-sealing fuel cell used in combat planes and wire cord tires *(254)*. The major development in tire design has been centered on extra low pressure tires utilizing wide base rims *(255-259)*. In discussing the fundamental principles of tire design, consideration has been given to the tire as an air-container, as part of the transmission system and as part of the suspension system *(260)*. Factors which affect the power consumption of pneumatic tires have continued to receive attention *(261)* and special consideration has been given to farm tractor tires particularly in relationship to wide vs. narrow base rims and the effect of liquid ballast on tire performance *(262)*. A description has been given of two Swiss passenger-train coaches with rubber tires which are said to give greater riding comfort, reduced wear and improved braking power *(263)*.

A rubber heating pad bonded to the inside surface of the jet cowl in an experimental plane has suggested possibilities of heated rubber as protection against icing *(264)*. Pliotherm heating units, covered with rubber or plastics in a range of colors, are electrical resistors that develop heat upon application of current and are said to offer a simple means of heating homes *(265)*. Data have also been made available on Uskon radiant heating panels which generate heat from a conductive rubber resistance element sandwiched between several layers of phenolic laminates *(266)*.

A report has been made of an analytical study of all available experimental data relating to human tolerance of vertical sinusoidal vibration with the objective of deriving the safe limit of vibration intensity for vehicle passenger comfort *(267)*. Claiming that rubber is potentially the best springing material for vehicles known today, it has been urged that the time is ripe for introduc-

tion of rubber into vehicle suspensions particularly because of the current importance of such suspensions in design and the adoption of independent front suspension *(268)*. A vibration-control unit with a load capacity ranging from 25 to 125 lbs. per unit is said to provide greater horizontal stability than all-rubber mountings. The new mounting utilizes a conical spring molded within the rubber *(269)*. Load deflection factors in the design of rubber suspension units have been given consideration *(270)* and, in a study of rubber anti-vibration devices, attention is given to the theory of elastic suspensions and how rubber can be applied practically to such applications *(271)*. The rubber torsilastic suspension system also has been given further study *(272)*.

Proper molding technique for the production of O-ring hydraulic packings which require close tolerance has been pointed out *(273)* while the factors affecting the performance of aircraft hydraulic packings have been reviewed *(274)*. Development in rubber materials for gaskets since 1939 has proceeded along two lines: (1) the improvement in existing materials such as copolymerization of chloroprene with isoprene to give a material (Neoprene-FR) with better resistance to cold, and (2) the development of new materials such as the Silastics with resistance to both high and low temperatures *(275)*. Rotproof gasket material that remains pliable and resilient under cold weather conditions and long service consists of Fiberglas cloth coated with rubber. It has been installed on the vertical and windshield edges of folding doors of school buses *(276)*. A check valve utilizing a flexible tubular operating member effects positive bubble-tight shut-off and permits unrestricted streamlined flow *(277)*.

Chemically-blown sponge rubber as applied to engineering design has been dealt with, particularly in respect to its use for automotive sealing, cushioning, and vibration damping problems *(278)*. An automotive seat and seat back consisting of an inflated air bag overlaid with foam rubber is claimed to give greater riding comfort *(279)*. Basic lubrication principles being used for other applications have been utilized in rubber stern bearings to improve the wearing qualities substantially *(280)*. Although none of the synthetic rubbers and resins are perfect as insulation, it has been said that their proper use will result in more reliable and longer lasting wire and cable insulation *(281)*. GR-S-65 has been presented as a special purpose copolymer with low water absorption and soap content which make it superior for the manufacture of insulated wire and cable *(282)*. A new submarine cable employs Telcothene, a mixture of polythene and polyisobutylene, as the main insulating material *(283)*. A light-weight neoprene jacketed borehole and mine entrance cable utilizes aluminum instead of copper, permitting a 30 to 50% saving in cost and 50% saving in weight *(284)*.

Two detailed studies have been presented on rubber as a material of construction *(285, 286)*, including data on formulations, properties, and applications. The use of rubber in architecture and building has also been treated *(287)*. New evidence has been presented in favor of rubber in asphalt road compositions based on road surfaces laid in 1938 *(288)*. A report has been made of latex with Portland cement for indoor flooring *(289)*, and a procedure has been outlined for carrying this out satisfactorily.

Considerable attention has been given to the use of rubber, its derivatives and related synthetic polymers in paints and protective coatings *(290-297)*. Practical experience on the use of synthetic rubber base inks has been reported *(298)*. Applications based on latex include curled animal hair bonded with rubber *(299)*, impregnation of paper *(300)* and production of artificial leather *(301)*. The application of rubber thread to textiles *(302)* and the durability of rubberized cotton and cellulose acetate in fabrics *(303)* have been treated. Rayon tire-cord fabrics have been given increased adhesion toward rubber by recent methods *(304, 305)*.

Extensive work has been done on the bonding of rubber to metal and a number of studies, some of them highly detailed and comprehensive in nature, have been made available *(306-313)*. The bonding of latex to wooden surfaces has also been covered *(314)*. Several studies have been presented on properties and applications of industrial adhesives for various applications *(315-317)*.

Silicone elastomers have come in for further attention, particularly in relation to the extension of their unique properties to difficult design problems *(318-324)*. Emphasis has been placed on the exceptional thermal stability of the silicones and their resistance to deleterious effects of weather, oil, chemicals, etc. The silicone rubbers and their mechanical properties, swelling characteristics, electrical properties, and ability to adhere to glass are described with reference to applications in hydraulic seals, belting, coated fabrics, gasketing and electrical devices *(325)*. Especially suited for low and high temperature service, the silicone elastomers should not generally be used where the temperature application is between –25° and 125°C. In a further application study of the silicone rubbers, consideration is given to the basic stability of these materials to high and low temperature and to the effects of weather and oils *(326)*. The inherent stability of these polymers is suggested by reference to chemical structure and bond energy between silicon and oxygen atoms, as well as the fact that special compounding is not necessary to produce stocks resistant to many conditions. Silicone rubber is bonded to itself and to glass, metal and ceramics by a new silicon-type adhesive that remains flexible and resilient over temperatures ranging from –70° to 520°F. *(327)*. Silicone sponge rubber is claimed to maintain its properties and flexibility over a wide temperature range *(328)*.

A highly flexible neoprene polishing wheel is said to

Interest in domestic rubber-bearing plants was maintained during 1948. The euphorbia plants seen here are grown by U. S. Rubber in N. J.

be effective for finishing stainless steel, glass, and nonferrous and precious metals *(329)*. By encasing a cast aluminum or bronze core in rubber, a propellor for outboard motors is rigid enough to cut the water, yet sufficiently resilient to slide over weeds without fouling and to bounce over obstacles without shearing the drive-shaft pin *(330)*. A belt with rubber teeth for use with grooved pulleys is said to prevent belt slippage *(331)*, while a ribbed-top conveyor belt has been designed to prevent backslip in carrying sand and gravel, wet-mixed concrete, gold dredging and other "soupy" materials up steep inclines *(332)*. A hot-materials conveyor belt is cushioned with rubber and strengthened with glass-fiber fabric *(333)*. An impact-cushioning idler for belt conveyors consists of rubber rings mounted on the idler core instead of the conventional rubber-covered steel idler *(334)*. Maximum deflection is said to be about six times greater than the standard type.

A new glass cord steam hose, which will carry saturated steam at temperatures of 388°F. at a pressure of 200 pounds, utilizes Fiberglas cords 25/1000 inch in diameter to give a wall only 9/32 inch in thickness *(335)*. A hydraulic hose for aircraft hydraulic applications uses special steel wire with a tensile strength of over 400,000 psi and is said to withstand pressures in excess of 3,000 psi needed in operation *(336)*. A considerable number of plastics and elastomers have been tested for permeability to tetraethyl lead and ethylene bromide with a view to make better protective work gloves *(337)*. Other application treatises have dealt with food packaging *(338)*, gas masks *(339)*, non-metallic fuel tanks for aircraft *(340)*, rubber lining *(341)*, and meteorological balloons *(342)*.

General Outlook

Last summer, the Office of Domestic Commerce revised upward expected 1948 United States consumption of new rubber, natural and synthetic, to 1,050,000 long tons and foreign demand was placed at 825,000 long tons. The current position of natural rubber vs. synthetic is reflected in United States consumption figures for June, 1948—natural rubber 55,701 long tons, GR-S 30,439 long tons, butyl rubber 5,370 long tons, neoprene and nitrile types 3,395 long tons, or a total of 94,095 long tons. Mandatory use of GR-S and butyl rubber, now restricted to transportation uses, amounts to less than 30% of total new rubber consumption. In June, 1948, the rubber industry voluntarily consumed 8,547 long tons of GR-S and 3,501 long tons of other synthetics for non-transportation rubber articles. A new law, known as the Rubber Act of 1948, became effective on April 1, 1948, and expires on June 30, 1950 *(343)*. It is interesting to note that this law states: "It is further declared to be a policy of the Congress that the security interests of the United States can and will best be served by the development within the United States of a free, competitive synthetic-rubber industry." Despite this statement of intent there appears to be considerable doubt regarding the disposition of our synthetic-rubber producing industry and the termination of government ownership.

Rehabilitation progress on natural rubber-producing areas of the Far East as well as Malayan rubber policy and pricing of natural rubber have been the subject of discussion *(344-347)*. The relative merits of GR-S and natural rubber have been compared *(348)* and the impact that synthesis may have on the rubber industry as a whole has been pointed out *(349)*. Another study deals with the relationship of rubber and plastics emphasizing selection based on application *(350)*.

An authoritative and comprehensive study of the structure, techniques, economics, history and prospects for the rubber industry from 1929 to 1947 has been presented emphasizing monopolistic control of rubber, the principal aspects of future competition between synthetic and natural rubber, and the present position and future prospects of the industry as a whole *(351)*. In reviewing the government's activity in the rubber field, the functions of the Office of Rubber Reserve have been reviewed *(352)*. The post-war status of the rubber-manufacturing industry in Europe has been outlined *(353)* and the position of rubber science and technology in the Netherlands during the war has been reviewed *(354)*. Revolutionary developments in the rubber industry are said to emanate from fundamental objective research; steady progress, on the other hand, is stated to be the likely result of inspired empiricism and applied research *(355)*.

Several studies of general interest cover a second, revised edition of a book on rubber science and technology *(356)*, work of the British Rubber Producers' Research Association *(357)*, education and training in the rubber industry *(358)*, and a discussion of nomenclature as related to synthetic rubber-like polymers *(359)*. Mention also should be made of four excellent reviews on rubber technology which appeared in the literature this past year *(360-363)*.

This survey gives evidence, through the extent of research and development effort expended in these few post-war months, that progress in rubber technology is moving forward. In conclusion, it should be emphasized that the period 1947-1948, while otherwise unspectacular in rubber technological advances, saw the development of a synthetic elastomer definitely superior to standard GR-S. Just how seriously this new rubber made by low temperature polymerization may affect the position of natural rubber still remains to be seen.

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Operating Under the Taft-Hartley Law. By Max Malin and S. Herbert Unterberger. Labor Relations Information Bureau, Washington, D.C. 8½ x 11 in. 58 pp. $2.00.

Designed for those who find it important to know just what the Taft-Hartley law means in handling every day situations, this newly-revised edition presents a complete and authoritative compilation of the act's provisions and their effect upon labor-management relations. The application of the act, contracts, strikes, and representation are some of the subjects covered in the booklet. The complete text of the Labor-Management Relations Act of 1947 is included.

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100 Million Motor Vehicles. Automobile Manufacturers Association, Detroit, Mich. 8½ x 11 in. 44 pp.

This booklet commemorates the production of 100 million motor vehicles in the United States between 1893 and 1948. Analyzing the impetus lent to the growth of the nation's economy through the development of motor transport, the booklet discusses the benefits gained by the individual citizen through the use of this medium. The booklet is profusely illustrated with photographs, charts and graphs documenting the industry's progress.

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Electrical Engineering Problems in the Rubber and Plastic Industries. American Institute of Electrical Engineers, 33 West 29th St., New York 18, N. Y. 8½ x 11 in. 55 pp. $3.00 ($1.50 to Members).

This pamphlet presents in printed form papers which were delivered at the conference sponsored by the Subcommittee on the Rubber and Plastic Industries of the General Industry Applications Committee of the American Institute of Electrical Engineers on April 20, 1948, in Akron, Ohio. Seven papers are presented in this pamphlet, many of them illustrated with charts and graphs.

Division of High-Polymer Physics, APS, Meets in New York on January 27, 28, 29

THE Division of High-Polymer Physics of the American Physical Society will hold its Sixth Meeting at Columbia University in New York City on January 27, 28 and 29, 1949, as a part of the joint meeting of the parent Society with the American Association of Physics Teachers. Comprising the Division program are more than 30 papers on the physics of natural and synthetic rubbers, and plastic and filamentous materials. Abstracts of most of the papers follow herewith:

ABSTRACTS OF PAPERS

Velocity and Attenuation of Sound in Butyl and GR-S Rubbers. ***R. S. Witte, B. A. Mrowca, and E. Guth (University of Notre Dame, Notre Dame, Ind.).***

Measurements were made in thin strips of rubber from 0.5 to 5 Kc and from —5° to 90° C. to extend the temperature range of the previous work [Thompson, Mrowca and Guth, paper at the New York Meeting of the American Physical Society, High Polymer Division, January, 1947, and A. W. Nolle, *J. Acous. Soc. Am.*, Vol. 19, pp. 194-201 (1947)]. Above room temperature velocity and attenuation are higher in Butyl gum than in GR-S. In all cases the velocity increases with decreasing temperature and increasing frequency. The attenuation shows a peak with temperature. For Butyl the peaks are broad and occur at higher temperatures than for GR-S. For both stocks an increase in frequency gives peaks which are higher and sharper, and shifted to higher temperatures. In some instances there are indications of peaks in the attenuation at frequencies beyond our range of measurement. The behavior of the dynamic modulus in the temperature and frequency range studied is similar to that of the velocity. These results combined with low temperature static measurements and very low frequency dynamic measurements at Notre Dame indicate a U-shaped modulus-temperature curve whose minimum broadens and shifts to higher temperatures with increasing frequency. The U-shaped curve can be explained by a generalization of the kinetic theory of rubber elasticity taking into account intra- (and inter) molecular forces, while the original theory gives only the ascending branch. The generalized kinetic theory is an analogue of the so-called Ising model used in the theory of ferromagnetism and surface adsorption. The dependence of the U-curve on frequency may be described by the introduction of a relaxation spectrum, which varies with the polymer, but is in general broader for high-loss rubbers. (Note: This work is supported in part by the Office of Naval Research).

Velocity and Attenuation of Supersonic Waves in Natural and Synthetic Rubbers. ***D. G. Ivey, B. A. Mrowca, and E. Guth (University of Notre Dame, Notre Dame, Ind.).***

The propagation of supersonic waves in some bulk rubbers was studied by Nolle and Mowry at 10 Mc. [*J. Acous. Soc. Am.*, Vol. 20, p. 432 (1948)]. A similar study from 50 Kc. to 10 Mc. and from —50° C. to 60° C. was made for Hevea, GR-S and Butyl gum and tread stocks. Peaks in attenuation versus temperature were observed. These peaks shift to lower temperatures with decreasing frequency. At a given frequency the peaks in Butyl occur about 40° C. higher than those in Hevea. The attenuation peaks for Butyl (a "high-loss" rubber) are broader and higher than for the other ("lower-loss") rubbers. For all stocks the velocity increases with frequency or decreases with temperature, leveling off at low temperatures.

These results are in qualitative agreement with data obtained by the strip method at much lower frequencies. However, for bulk waves the real and imaginary parts of two elastic constants (bulk and shear moduli) determine sound velocity and attenuation. Comparison with low frequency data requires independent measurement of the shear properties as a function of frequency. In the absence of such measurements only qualitative comparisons can be made. These measurements extend the frequency range studied by the strip method (*cf* preceding abstract) over several decades, and thus give a qualitative knowledge of the relaxation spectrum over a wide range. The interpretation of the preceding abstract also holds for this extended range. (Note: This work is supported in part by the Office of Naval Research).

Rigidities of Polyisobutylene and Polyvinyl Acetate Solutions from Wave Propagation Measurements. ***John D. Ferry, J. N. Ashworth, and W. M. Sawyer (University of Wisconsin, Madison, Wis.).***

Although concentrated solutions of linear high polymers behave as viscous liquids in steady flow, they support transverse waves at audio frequencies. The wave propagation is characterized by the wave shear modulus, G, and damping index, λ/x_0. In polyisobutylene solutions, G increases only slightly with frequency, is independent of temperature at constant volume concentration (c), is proportional to c^3, and depends comparatively little on the choice of solvent. In polyvinyl acetate solutions, G increases considerably with frequency, falls off with increasing temperature, is proportional to c^3, and is markedly different in different solvents. The results are interpreted in terms of a transient network structure formed by random entanglements of the long chain molecules.

Dynamic Mechanical Properties of Some High Polymers. ***R. Buchdahl, L. E. Nielsen, and Rita Revreault (Monsanto Chemical Co., Springfield, Mass.).***

The dynamic elastic modulus and mechanical dissipation factor for a series of high polymers have been determined as a function of temperature. Data were obtained by different methods: (a) electromagnetic vibrators, (b) torsion pendulum, and (c) rotating cantilever beams. The frequency of applied stress varied from 0.04 to 100 cycles per second. Among the materials investigated were polystyrene, polyvinyl chloride, and cellulose acetate. Most of the materials are characterized by a transition over a limited temperature range in which the modulus changes rapidly with temperature and the dissipation factor goes through a maximum. This transition is slightly frequency dependent. The results of the dynamic tests are compared with other mechanical properties of the materials studied. Some discussion of the mechanisms of deformation and damping is given for high polymers.

Acoustic Measurements of Polymer Physical Properties. ***J. W. Ballou and J. C. Smith (E. I. du Pont de Nemours & Co., Buffalo, N. Y.).***

Acoustic methods for measuring the elastic and dissipative properties of high polymers in fiber and film form over four decades of frequency (3 to 30,000 cycles per second) are described. The experimental quantities resulting from the three different techniques necessary to cover this range are shown to be related, and are unified by deriving in each case the parameters of an equivalent Voigt Model (elastic and viscous element in parallel) which would behave in the same way as the polymer sample.

Examples of the application of these techniques to the characterization of high polymers are given. The effect of frequency and chemical and physical structure on the derived parameters are discussed, along with the question of heat losses resulting from cyclical differential deformation. In addition, the application of two of the methods to the characterization of the stiffness-temperature behavior of high polymers is described.

Elastic Losses of Elastomers at Ultrasonic Frequencies. ***H. S. Sack and R. W. Aldrich (Cornell University, Ithaca, N. Y.).***

The elastic losses in the frequency range of 0.5 to 6 Mc were determined by measuring the absorption of plane ultrasonic waves in sheets of the material of different thicknesses. In order to avoid the difficulties caused by standing waves, frequency modulated waves were used. The results were checked in some cases by using a pulsed ultrasonic beam. All the measurements were made with the samples immersed in water. The samples studied were natural rubber, butadiene-styrene copolymers of different concentration (85-15 to 60-40), without and with carbon black (gum stock and tread stock). In general, the absorption (per wave length) increases with increasing frequency, but the increase is less rapid at higher frequencies. The loaded samples have a higher absorption. As in the low frequency range, the losses in the copolymers increase with increasing styrene content and with decreasing temperature (1° C. —50° C.). The curve shapes can be explained by relaxation phenomena with one or two relaxation times of the order of 10^{-7} seconds. For a more quantitative interpretation measurements at higher frequencies are desirable. (Note: This research has been supported by the Office of Naval Research under Contract N6-ORI-91, Task 2).

Creep and Damping Properties of Polystyrene. ***John A. Sauer and Joseph Marin (Pennsylvania State College, State College, Penna.).***

Creep-time measurements were made on polystyrene specimens for various values of stress. The data are given for specimens subject to tension loading, torsion loading and also pure bending. Analysis of the data indicates that the log of the creep rate is proportional to the log of the stress amplitude, and that the torsion and bending creep properties can be approximately estimated from the creep properties in tension.

The damping properties of polystyrene under alternating tension-compression loading have been determined by use of a resonant method. The results indicate that the damping capacity varies approximately as the stress to the 2.4 power. Tests made on other high polymers, including both thermoplastic and thermosetting materials, show a similar dependence of damping capacity on stress amplitude. These data are used for assessing the relative merits of plastic materials when operating at resonance.

Non-Linear Viscous Elasticity and Secondary Bond Rupture. ***G. D. Halsey, Jr. (Harvard University, Cambridge, Mass.).***

In the study of the visco-elastic behavior of wool and rubber-like materials, the spring-dashpot model is discarded in favor of models based on the rupture of secondary bonds. If these bonds are connected in series the typical rubber-like stress-strain curve results. The exact nature of the curve depends on how these bonds break and reform. The resulting stress-strain curves cannot be explained with a spring-dashpot model, even including non-linear elements. Further study shows the presence of bonds in parallel, on which the stress concentrates owing to breakage. The presence of these bonds allows thixotropic humps and rupture to be explained. The various conditions under which these different explanations are valid and required are discussed.

Reinforcement and Swelling of Butyl Rubber Filler Systems. ***Robert L. Zapp (Standard Oil Development Co., Elizabeth, N. J.) and Eugene Guth (University of Notre Dame, Notre Dame, Ind.).***

This study is an attempt to gain further insight into the reinforcement of polymeric networks by filler particles through the agency of volume swelling of Butyl rubber vulcanizates. Because of its low chemical unsaturation, a maximum state of cure can be realized with all types of filler loadings while the network remains in a soft and elastic condition. Thus, filler reinforcement is compared in networks of equal concentration of chemical cross-links.

In this study carbon blacks of varying particle diameter are compared to representative types of mineral fillers. In the case of carbon blacks, as the volume loading is increased the volume swelling of the pure hydrocarbon polymer is reduced. With mineral fillers this effect is not as evident, and in some cases there is little or no change of volume swelling (over a non-pigmented control) as volume loading of the mineral filler increases. Comparisons between the volume swellings of a pigment network and its elastic properties indicate that there is a direct correlation between the increase in elastic modulus and the reduction in volume swelling.

A comparison between the contribution of chemical cross-links and secondary filler forces to network rigidity, is discussed. An analysis of the relative contributions of carbon blacks and mineral fillers based upon the actual surface area added per volume of polymer shows the superiority of the carbon surface (regardless of particle size) over mineral pigment surfaces. Photomicroscopic evidence corroborates the data on filler surfaces.

A Kinetic Concept of Elasticity. ***R. S. Barker, W. O. Seifert and J. H. Dillon (Textile Research Institute Labs., Princeton, N. J.).***

Prediction of the mechanical behavior of high polymeric materials under stress has received much attention of late years. Several workers have given attention to such materials as natural rubber, polyethylene, and cellulose derivatives. Such considerations led to network theories for rubber. Tobolsky, Eyring, Halsey, et al, applied modern reaction rate theory to their mechanical concept of materials exhibiting time dependency. This work gave good results for cellulose derivative fibers, but seemed inapplicable in its simple form to many other important polymeric materials.

The Office of Naval Research has sponsored a program of study on the Resilience of Fibers in the Princeton laboratories of the Textile Foundation. In connection with this program, experimental and theoretical studies were made on materials showing, in the terms of previous theories, an anomalous behavior. A new concept of flowing molecular chain deformations in the amorphous regions of fibrous materials has resulted in the formulation of a new theory of elasticity. The mathematical formulations of stress-strain-time relations based on this kinetic viewpoint coupling the chemical structure of polyamides and the energetics of their deformation have resulted in equations which not only conform to the experimental data, but also allow the prediction of the behavior of the given polymeric material under stress. The results of x-ray diffraction studies lend validity to the theory.

Dependence of the Tensile Strength of Vulcanized Rubber on the Degree of Cross-Linking. ***Paul J. Flory, Norman Rabjohn and Marcia C. Shaffer (Goodyear Research Laboratory, Akron, Ohio).***

Tensile strengths of natural rubber samples quantitatively cross-linked with decomethylene dis-methyl azodicarboxylate have been determined. The rapid increase in tensile strength with the degree of cross-linking ρ for small values of this quantity is consistent with the hypothesis that the tensile strength is directly related to the fraction of the structure which is permanently oriented by stretching. At higher degrees of cross-linking ($100\ \rho = 1.0$ to 1.5, depending on the molecular weight of the rubber) the tensile strength passes through a maximum and then declines steadily to quite low values for higher ρ's. This adverse effect of higher degrees of cross-linking is believed to result from the diminished elongation at which crystallization sets in and, hence, the smaller fraction of the network elements sufficiently oriented to participate in crystallite formation.

Modification of up to 7% of the isoprene units of the rubber with the monofunctional compound, ethyl azodicarboxylate, depresses the tensile strength of the dis-azo vulcanized rubber relatively little. Evidently, the limited extent to which these modified chains may enter into crystallization is adequate to bring about high tensile strength. Deviations from the mean for 262 tests are well represented by a Gaussian error function. (Note: The work presented in this paper was carried out at the Goodyear Research Laboratory under contract to the Office of Naval Research).

Equation of State for Polystyrene. ***R. S. Spencer and G. D. Gilmore (Dow Chemical Co., Midland, Mich.).***

Practical considerations emphasize the desirability of formulating an adequate equation of state for polystyrene. A fairly satisfactory one is this simplified version of van der Waal's equation,

$$(P + \pi)\ (V - \omega) = nRT$$

where π is the internal pressure (or cohesive energy density) and ω is the volume at absolute zero, by extrapolation. Evalu-

ating constants from thermal expansion data [Spencer and Boyer, *J. Applied Phys.*, Vol. 17, p. 398 (1948)] and expressing P in p.s.i., V in ccs. per gram, and T in degrees Kelvin, this becomes

$$(P + 27{,}000)\ (V - 0.822) = 11.6T.$$

Agreement with compressibility measurements, which are described in some detail, is good. Discrepancies with room temperature values of sound velocity and cohesive energy density by swelling measurements [Boyer and Spencer, *J. Polymer Sci.*, Vol. 3, p. 97 (1948)] are discussed briefly.

Relationship Between Structure, Mechanical Properties and Birefringence in Polymeric Materials. ***R. S. Stein, S. Krimm, and A. V. Tobolsky (Frick Chemical Laboratory, Princeton University, Princeton, N. J.).***

A thermodynamic analysis of the stretching properties of polyvinyl chloride and lactoprene is made by use of reversible stress temperature data. Simultaneous birefringence measurements are used to infer configurational changes of these polymers during stretching. Configurational changes accompanying "second order transitions" are discussed in terms of the experimental data.

The Performance of a Light Scattering Photometer for Determining High Molecular Weights. ***B. A. Brice (Eastern Regional Research Laboratory, Philadelphia 18, Penna.).***

A photoelectric photometer designed for the measurement of absolute turbidity, dissymmetry, and depolarization of dilute solutions of high molecular weight materials is described. Improvements over an earlier model include use of opal glass as a reference transmission diffusor, a multiplier phototube receiver, and compensation of most of the refraction effects [Speiser and Brice, *J. Opt. Soc. Am.*, Vol. 34, p. 364 (1946)]. The working relationships leading to determination of absolute turbidity are developed, both for a "substitution" method and a "working standard" method. Sources of error encountered in earlier work and remedied include: serious deviations from the cosine law of emission for a reflecting diffusor of magnesium carbonate; dependence of response of phototube on plane of polarization of incident radiation; and refraction effects. Data illustrating the performance of the instrument include determination of Rayleigh's ratio and depolarization for benzene; molecular weights of sucrose octaacetate, lactoglobulin, serum albumin, and fractions of polystyrene. Agreement with other methods for these materials is in general within $\pm 5\%$.

A Method of Measuring Molecular Weight Distribution Breadth. ***F. W. Billmeyer, Jr., and W. H. Stockmayer (E. I. du Pont de Nemours & Co., Wilmington, Del.).***

Based upon the suggestion of Spencer [*J. Polymer Sci.*, Vol. 3, p. 606 (1948)] a method for estimating the breadth of the molecular weight distribution of a high polymer has been devised: A polymer solution is divided into aliquots and part of the polymer in each aliquot is precipitated with non-solvent so that the range from complete solution to complete precipitation is covered. The weight and (weight-average) molecular weight of each precipitate is measured. From these data the distribution breadth is estimated in terms of a parameter H representing the departure of the distribution from that of a single molecular species. In the theoretical section H is related to other parameters of distribution breadth, such as $\overline{M}w/\overline{M}n$, for some well known analytical distribution functions. A number of experiments with polymethyl methacrylates are described and the results are discussed with reference to polymerization kinetics. Osmotic pressure and light scattering determinations have been made to evaluate directly $\overline{M}w/\overline{M}n$. The values compare favorably with $\overline{M}w/\overline{M}n$ estimated from H. Errors in both the theoretical and experimental treatments are discussed.

Determination of the Shape of Particles from Dityndallism. ***Wilfried Heller (Wayne University, Detroit, Mich.).***

A conclusive determination of the shape of colloidal crystals or molecules is possible by studies of the conservative dichroism or of the dityndallism. In order to occur, these effects require a partial orientation of the respective particles by streaming, in an electric or a magnetic field. A determination of the basic shape (spheres, prolate or oblate spheroids) is possible without using the distribution function. By means of the latter, the three dimensions can be determined numerically and without difficulty, if all dimensions are small compared to the wave-length of light. The method is therefore particularly promising for numerical determinations of the three dimensions of protein molecules. It can also be anticipated that the method will allow a decision as to whether or not the statistical shape of polymer molecules varies with the solvent. The Langevin-Cotton relation makes it possible to decide as to whether or not the shape of non-rigid particles may change during the process of orientation, thus providing a quantitative tool for the study of possible hydrodynamic deformations of particles. An apparatus for the study of conservative dichroism and one for the study of dityndallism will be discussed and a number of systematic preliminary data obtained with rigid colloidal particles will be presented.

The Inter-Relationship of Some of the Hydrodynamic Properties of Flexible Molecules In Solution. ***Jacob Riseman (Polytechnic Institute of Brooklyn, Brooklyn, N. Y.).***

The viscosity, diffusion and sedimentation velocities of solutions of flexible molecules are intimately associated with the relative motion of the solvent in the vicinity of the segments of the chain. This motion is, in turn, to a large extent determined by the hydrodynamic interaction which occurs between the parts of the chain. Analogously, the orienting effect of a velocity gradient depends upon the magnitude of the rotatory Brownian motion of the particle, and therefore on the rotatory diffusion constant of the particle. Since this latter quantity is influenced by the resistive forces of the fluid in which it is immersed, it follows that there should be a relationship between the rotatory diffusion constant and the above-mentioned properties. In particular, the rotatory diffusion constant is shown to be simply related to the intrinsic viscosity. Furthermore, data obtained from diffusion and sedimentation velocity measurements can also be used to calculate the rotatory diffusion constant. This therefore enables one to correlate viscosity, ultracentrifuge and birefringence data, since from the latter the rotatory diffusion constant can be obtained. In addition, from such birefringence data one can obtain the size of the molecule, by comparing the experimentally obtained rotatory diffusion with that theoretically obtained.

Relationship Between Gough-Joule Coefficients and Moduli of Vulcanized Rubbers. ***F. S. Conant, G. L. Hall, and G. R. Thurman (Firestone Research Laboratory, Akron, Ohio).***

The Gough-Joule coefficients (a) at constant stress and (b) at constant strain are defined and methods of measurement of each on vulcanized rubbers are given. It is shown mathematically and experimentally that the ratio of (b) to (a) is equal to the "tangent" modulus. The quotient of the Gough-Joule coefficient at constant stress divided by the stress and the quotient of the Gough-Joule coefficient at constant strain divided by the strain are shown to be constants which are independent of the stress-strain-temperature conditions of the test. Experimental data are given for stocks based on Hevea, GR-S, Neoprene GN, Butyl Rubber and Butaprene.

Polymerization in the Solid State. ***E. Miller, I. Fankuchen, and H. Mark (Polytechnic Institute of Brooklyn, Brooklyn, N. Y.).***

Some substances can apparently polymerize while in the solid state. One such material has been studied in this laboratory in some detail.

The melting point of ϵ-carbobenzoxy-α-carboxyl-l-lysine anhydride stored in stoppered vials at room temperature for periods up to one year has been observed to rise considerably above that of the freshly prepared sample (m.p. 101°). Comparison of x-ray diffraction diagrams of fresh monomer, aged monomer, and bulk polymer indicate that the aged monomer samples suffered disorientation with distinct changes in the Bragg reflections, and the diagrams of the aged specimens appear to be similar to diagrams given by bulk polymer.

Samples of freshly prepared monomer were heat-treated in the solid state at different temperatures below the melting point for periods up to one week. X-ray studies of these samples suggest that the threshold temperature for the disorientation process is about 70° C. The process appears to be complete in samples heat-treated at 85° C. since their x-ray diagrams resemble those of bulk polymer, and no further change is observed at higher temperatures.

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Time and Stress Effects in the Behavior of Rubber at Low Temperature. ***J. R. Beatty and J. M. Davies (B. F. Goodrich Research Center, Brecksville, Ohio).***

The stiffening of rubber-like materials at low temperatures involves several different phenomena, sometimes with their effects superimposed. One of these is crystallization. This is a rate process which is generally very fast at high stresses and very slow at zero stress. In these experiments at temperatures near —25° C. and under a shear stress of about 148 psi the dynamic modulus of the rubber increased at a rate convenient to study. Correlation with X-ray data showed that crystallization was responsible for the increase in stiffness. The rate of change of stiffness increased rapidly with increase in applied stress, and there was no optimum temperature as has been found for unstressed rubber. The amount and kind of vulcanization influenced the stiffening, tighter cures giving smaller changes. Neoprene FR and polybutadiene, which ordinarily show little evidence of crystallization, showed very definite, but small increases, in stiffness. The results with GR-S were less definite but in some cases there were definite changes. Mixing GR-S with natural rubber seems to limit the crystallization of the natural rubber rather effectively, but apparently Neoprene FR does not mix intimately enough with natural rubber to affect the crystallization of the latter appreciably.

The Compatibility, Efficiency and Permanence of Plasticizers. ***R. F. Boyer (Dow Chemical Co., Midland, Mich.).***

This paper attempts to inter-relate three important aspects of plasticizer behavior: *compatibility,* or how much plasticizer can be added without causing phase separation; *efficiency,* or how much a given amount of plasticizer lowers the brittle temperature; and *permanence,* or how well a plasticizer is retained by the polymer on heat aging or solvent treatment.

Compatibility is discussed in terms of the Flory-Huggins theory of the thermodynamics of polymer solutions, which relates the activity of the plasticizer to its concentration in the polymer. Efficiency is measured by how the plasticizer lowers the melt viscosity of the polymer. An empirical relationship between efficiency and μ (the Huggins polymer-solvent interaction constant) is shown. Loss of plasticizer at elevated temperatures depends in part on the effective vapor pressure of the plasticizer, and in part on how rapidly diffusion of plasticizer from the interior of the sample replenishes that lost from the surface.

From the fact that diffusion constant times viscosity is a constant, it is possible to correlate measured diffusion rates with plasticizer content and with plasticizer efficiency. A linear relationship is predicted and found experimentally between logarithm of the diffusion constant and the brittle temperature. In this sense, the more efficient a plasticizer is, the more rapidly it can diffuse out of the polymer and be lost. Consideration is given to the effect of plasticizer on electrical resistance and tensile strength. A preliminary discussion of polymeric plasticizers is presented.

Mechanical Properties of Polystyrene Films Cast From Solvents. ***E. Merz, L. Nielsen, and R. Buchdahl (Plastics Research Laboratory, Monsanto Chemical Co., Springfield, Mass.).***

Using a 2 x 2 block with replication design of experiment, the reproducibility of casting polystyrene films from methyl ethyl ketone and benzene was investigated. Various drying cycles were utilized to reduce the concentration of solvent so that there would be no effect on the mechanical properties. Tensile strength, creep at elevated temperatures and dynamic modulus and damping capacity measurements were used as criteria of dryness. The instrument used to measure the dynamic elastic modulus and loss factor is described in some detail.

The mechanical properties of "dry" benzene films differed from the properties of the "dry" MEK films. The change of the dynamic elastic modulus and loss factor near the so-called second order transition point as a function of temperature and the effect of very small amounts of solvents on this transition region are discussed.

Infrared Studies of Neoprene. ***M. B. Hall and W. E. Mochel (E. I. du Pont de Nemours & Co., Wilmington, Del.).***

Infrared absorption spectra of amorphous and crystalline neoprene in the wave length range 2-23 microns have been studied. Spectra of bromoprene and other reference compounds, the dichroism of stretched samples, and the spectral changes accompanying crystallization have been used to characterize the bands and to "assign" most of the strong bands to vibrations of more or less limited regions of the molecule.

Spectral changes, some very pronounced, accompany crystallization of the polymer either in the unstretched state or following stretching. Perceptible spectral changes were found to occur for some twelve hours following stretching of Neoprene GN, a type which tends to crystallize slowly. These spectral changes, particularly the surprising appearance of strong absorption bands when the polymer crystallizes, are of interest because of their relation to order in the polymer and also because of their bearing on general infrared applications, particularly quantitative analysis of polymer films.

X-Ray Diffraction Studies on the Stretching and Relaxation of Polyethylene. ***Alexander Brown (Carbide and Carbon Chemicals Corp., South Charleston, W. Va.).***

When polyethylene is stretched at 96° C., the orientation of the crystallites changes smoothly from a random configuration to a highly preferred one. This preferred orientation is "normal," and has the long chain axes of the crystallites parallel to the stretching direction. However, when stretching is carried out at room temperature a different preferred orientation occurs at intermediate degrees of stretch. This preferred orientation is "abnormal," and in it the long chain axes of the crystallites are inclined at almost right angles (72°) to the stretching direction. As stretching proceeds past this intermediate extension range, the preferred orientation gradually changes to the "normal" one. This same "abnormal" preferred orientation exists in the region of the "neck" in necked down polyethylene.

When highly stretched polyethylene is relaxed by heating, the disorientation of the crystallites in the "normal" preferred orientation does not occur in a gradual and random manner. Instead of the preferred orientation remaining constant and the distribution about it merely becoming broader, the preferred orientation itself changes.

Macromolecular Nomenclature. ***M. L. Huggins (Eastman Kodak Research Laboratory, Rochester 4, N. Y.).***

A report on nomenclature in the field of macromolecules has been prepared by the National Research Council Committee on Macromolecules for submission to the corresponding commission of the International Union of Chemistry. This report will be outlined and parts related especially to high polymer physics will be presented in detail, with the object of evoking discussion, criticism and suggestions for revision before final adoption.

Equilibria in the Dyeing of Nylon With Acid Dyes. ***W. R. Remington and E. K. Gladding (E. I. du Pont de Nemours & Co., Wilmington, Del.).***

A mechanism for the acid-dyeing of wool proposed by Gilbert and Rideal postulates that (1) amino and carboxyl end-groups ionize within the fiber to produce carboxylate ions ($—COO^-$) and alkyl ammonium ions ($—NH_3^+$) and (2) dye uptake by the fiber consists of combination of dye anions with the $—NH_3^+$ groups and hydrogen ions with the $—COO^-$ groups. Gilbert and Rideal's equation has been modified to allow for the excess of carboxyl over amino end-groups in nylon and rearranged so that the data could be tested by means of a linear plot. The latter has permitted an estimate of the number of amino end-groups present in the fiber.

Nylon staple was equilibrated with aqueous buffers of varying pH and dye concentration and the distribution of dye between the fiber and the bath was determined. The data were found to be in accord with the suggested mechanism for both single dyes and mixtures of two dyes. Equilibrium constants were determined with a probable error of 12% and amino end-groups were determined to within about 5%.

The loss in tensile strength of nylon dyed under excessively severe conditions was shown to be caused by hydrolysis of amide linkages.

Pyrolysis of Hydrocarbon Polymers. ***S. L. Madorsky, S. Straus, Dorothy Thompson, and Laura Williamson (National Bureau of Standards, Washington, D.C.).***

Samples (25-50 mg) of hydrocarbon polymers, such as polystyrene, polyisoprene, polyisobutene, polyethylene, polybutadiene and GR-S, were pyrolyzed in a high vacuum at 350 to 450° C., in a specially designed apparatus. Pyrolysis resulted in a mix-

ture of paraffins, monoolefins, diolefins, etc., varying in molecular weight from 16 to about 1000. The mixture was separated into a gaseous liquid intermediate and wax-like fractions. Mass spectrometer analysis of the gaseous fraction showed it to consist in all cases of a small amount of methane. Similar analysis of the liquid fraction gave a spectrum characteristic for each polymer investigated. This spectrum can be used to identify the polymer or to determine its purity. Due to the fact that the mass spectrometer, at the present stage of development, is not capable of analyzing organic compounds over 100-150 molecular weight, the intermediate and wax-like fractions were not analyzed. A molecular weight determination, by the freezing point lowering method, of the wax-like fractions gave values varying from 264 in the case of polystyrene to 775 in the case of polybutadiene.

Dilatometric Studies of High Polymers. I. Second Order Transition Temperature. ***Harry J. Kolb and Emmette F. Izard (E. I. du Pont de Nemours & Co., Wilmington, Del.).***

By means of a density balance, the relationship between intrinsic viscosity and dilatometric properties is established for polyethylene terephthalate. The most pronounced property change associated with increasing intrinsic viscosity was observed to be the second-order transition temperature. The relationship between crystallinity and dilatometric properties is presented for 3 aromatic polyesters. In every case, increased crystallinity in the polymers is associated with higher second-order transition temperatures, larger transition range, higher density and lower volume coefficients of expansion. Second-order transition temperatures, densities at 0° C., and volume coefficients of expansion are presented for a number of polyesters and vinyl polymers to illustrate the effects of chemical structure as well as physical state on these dilatometric properties. Illustration of the effect of copolymerization on second-order transition temperatures is made with a copolyester system.

Dilatometric Studies of High Polymers. II. Crystallization of Aromatic Polyesters. ***Harry J. Kolb and Emmette F. Izard (E. I. du Pont de Nemours & Co., Wilmington Del.).***

By means of both a density balance and gradient tube, experimental density data are obtained to illustrate the thermal crystallization behavior of 3 aromatic polyesters at temperatures from 90° C. to 150° C. The data are discussed with reference to both amount and rate of crystallization, and density curves are presented to show qualitative similarity between kinetics of polymer crystallization and the kinetics of chemical reactions. From the experimental data, a temperature, for convenience labeled the minimum crystallization temperature, is described and is shown to be 30° to 50° above the second-order transition temperature for the polyesters. In addition to thermal crystallization, data are presented to show that immersion media may initiate crystallization below the minimum temperature associated with thermal crystallization of polymers. Liquids used as immersion media for polyethylene terephthalate were water, methyl alcohol, acetone, benzene, nitromethane, and nitric acid. The last four liquids initiate crystallization of the polymer at room temperature.

Mass Spectrometric Study of Copolymer Pyrolyses. ***L. A. Wall (National Bureau of Standards, Washington, D. C.).***

When copolymers are made from a monomer of the type CH_2CHX or CH_2CX_2 (A) and a monomer of the type CHXCHX or $CH_2CXCHCH_2$ (B), the pyrolytic yield of monomer A (Y_{A_0}) from a copolymer of any composition made at low conversion can be estimated from the relationship

$$Y_{A_0} = Y_{A_P} \frac{A}{A + r_B B} \left(1 + \frac{B}{2r_A A} \ln \frac{B}{r_A A + B} \right)$$

where Y_{A_P} is the yield from the polymer of A alone, A and B are concentrations of monomers used in preparing the copolymer, r_A is the ratio of rate constants for the propagation steps of A type radicals in copolymerization and r_B is similarly defined. The chief assumptions involved are: (1) equality of all bonds making up the chain in all sequences of A units, and (2) side reactions dependent only on the nature of A. Pyrolyses of 0.001 gram samples of styrene-butadiene and styrene-isoprene copolymers were carried out in small tubes adapted to allow complete expansion of all volatile products into the mass spectrometer. Plots of the mass 104 peak heights of monomeric styrene are in agreement with the above relationship.

Review of the Australian Rubber Industry

THE Minister for Postwar Reconstruction recently issued a brief review of the Australian rubber industry, prepared by the Division of Industrial Development. The review states that, in general, the supply of rubber goods is considerably short of demand. Notable exceptions are garden hose and bicycle tires. However, in almost all rubber products supply is increasing in volume. Local production is the principal source of supply for the domestic market.

It is estimated that present production of tires and tubes (other than bicycle) is about 20 per cent greater than before the war. Before the war Australian pro- the war, however, supply has not caught up with the increasing demand, and in fact, local production shows no immediate prospect of bringing about an easy supply position. Nevertheless, production of tires and tubes is closer to meeting demand than is that of most other rubber goods. The manufacture of tires, tubes and other rubber products for motor vehicles accounts for 75 to 80 per cent of all rubber consumed in Australia.

The industry is now producing tires for all uses at the rate of about 1,650,000 per annum as against 1,356,000 in 1938-39 but output is currently below estimated demand by nearly 250,000 units per annum. This deficiency is substantially made up as regards tires for new vehicles by imports and as regards vehicles already on the road by extended use of recapping and retreading. It is estimated that on the average every tire is now recapped or retreated at least once.

Demand in the case of tires for motor cars, motor cycles and utility vehicles has increased by about 25 per cent compared with the annual demand prewar, but the increase in the demand for tires, for trucks and tractors is now about 135 per cent greater than before the war. The annual demand for 1,600,000 tires for bicycles is being fully met from local production. The retail price of tires has risen 28% since pre-war.

Demand for industrial rubber hose is increasing. Production is about 8,000,000 feet per annum and this is not meeting requirements. Before the war less than 2 million feet per annum were produced.

The review states that in recent years there has been a fuller appreciation by consumers of the uses to which rubber can be put. The demand for miscellaneous goods made from rubber is peculiarly suited to stimulation by sales promotion and when circumstances permit an enormous latent demand will be revealed.

The rubber industry relies largely on imports from the dollar area for certain of its raw materials, such as tire cord and fabric. The review says that every effort should be made to expand local production of these materials.

The industry is likely to meet increasing competition from plastic products, and the large Australian companies are completing plans to enter into the production of plastics.

Editorials . . . . . .

Price Stabilization

ACCORDING TO H. Eric Miller, chairman of the board of Harrisons & Crosfield, Ltd., and one of the leading authorities in the rubber field, the United States should make purchases of natural rubber for stockpiling purposes from time to time to help stabilize the world price of the commodity. Mr. Miller's view in this direction was expressed at the recent annual general meeting of the company in London. He also expressed the opinion that American manufacturers' stocks of natural rubber are definitely on the low side.

There is little doubt that Mr. Miller's statement was raised as a trial balloon, particularly in view of the fact that the next meeting of the International Rubber Study Group is scheduled to be held in London within the next two months. Nevertheless, he is a keen student of the over-all rubber market and generally is the spokesman of leading natural rubber interests. Accordingly, it may be assumed that the suggestion that American stockpiling purchases be maneuvered to bolster a lagging price market represents the current thinking of rubber producers. The price of spot rubber in the New York market has fluctuated between 18 and 23 cents in recent months.

The proposal brought forth a quick response from one government official in Washington to the effect that the Munitions Board is not set up to manipulate world markets. Another official, directly concerned with purchases of natural rubber, pointed out that in a sense the stockpiling program acts as a stabilizing influence on the market since it is responsible for a steady flow of rubber, even though availability rather than price is the determining factor in all stockpiling transactions.

Still another official stressed the point that because the Munitions Board must make its allocations in advance prior to Congressional approval of the President's over-all budget before it can make any purchases, it would be extremely difficult to manipulate stockpiling purchases for price-stabilizing purposes. Incidentally, the proposed budget for the fiscal year ending June 30, 1950, provides $525,000,000 for the over-all stockpiling program as against $350,000,000 in the previous year.

In connection with his suggestion for American stockpiling purchases whenever the market showed signs of weakness, Mr. Miller made the observation that early in 1948, when the international atmosphere was even more tense than it now is, the urge to add to United States stocks was keener than it appeared to be quite recently when the market was looking for and needed some support. Oddly enough, he added, that support came in modified form from purchases made by the Russian Government "without which the price undoubtedly would have dropped to a level still more disappointing to producers."

The Harrisons & Crosfield chairman, in his annual statement, also gave indication of further thinking on the part of natural rubber producers when he expressed favor for the early return of a world-wide regulation system. Stating that the Regulation Agreement of 1934 which operated until the Japanese overran the Far East showed how price fluctuations can be kept within reasonable bounds, he added that "the best interests of world trade would be served by the adoption of some such measure within the terms of the I.T.O. Charter." But that's another editorial.

Stockpiling Mathematics

IN CONNECTION with stockpiling of rubber, the Goodyear Tire & Rubber Co. has just released a statement by Dr. R. P. Dinsmore which gives food for thought. Assuming that any future emergency period would extend four or five years, and accepting a figure of 1,000,000 tons for consumption per emergency year, the statement points out that we would have to stock some 5,000,000 tons, less whatever imports could be relied on. A liberal estimate of 30 to 40% of requirements from continuing imports still leaves a stockpile requirement of 3,000,000 to 3,500,000 tons, which of course is not obtainable.

Turning to annual production of natural rubber, the statement points out that such production is now about 1,500,000 tons and might rise to 1,800,000 tons over the next three or four years. Since consumption in foreign countries may be expected to continue at about 800,000 tons a year, the United States may be able to secure about 700,000 tons a year at present and this figure might rise to 1,000,000 tons in three or four years. From this supply we must carry on present rubber goods production and do whatever short-term stockpiling is deemed essential. As Dr. Dinsmore emphasizes, no higher mathematics are needed to demonstrate the critical need for domestic synthetic rubber production.

CURRENT NEWS OF THE MONTH

CIVIL ANTI-TRUST SUIT FILED AGAINST U. S. RUBBER COMPANY

A civil anti-trust suit charging the U. S. Rubber Co. and two British rubber concerns with unlawful cartel agreements preventing the import and export of products manufactured from rubber latex was filed in Federal Court in Cleveland, Ohio, by Attorney General Tom C. Clark on December 17. Named defendants in the suit along with U. S. Rubber, were Consolidated Rubber Manufacturers, Ltd., and Dunlop Rubber Co., Ltd., both of London, England. Thirteen other foreign companies were listed as co-conspirators, but not named defendants in the action.

The complaint charges that the defendants and co-conspirators, since 1932, have divided world markets in latex products, including rubber thread, elastic yarn and fabrics and other articles made from these goods, by unlawful agreements not to sell or ship such manufactured items to a territory allocated to another defendant or conspirator.

It is further charged that U. S. Rubber and four others organized International Latex Processes, Ltd., for the pooling of patents, inventions, processes and apparatus as well as technical information. Then International Latex licensed the defendants and co-conspirators and other selected licensees who could be relied upon not to cut prices, the Government charged.

Asks Dissolution of Cartel

The suit asks that the restrictive cartel arrangements between the defendants and their co-conspirators be terminated and that the defendants divest themselves of all financial interests in the jointly owned companies. It requests that the court take action with respect to patents, trademarks and trade names to the extent it deems necessary to dissipate the effects of the unlawful activities and to establish free competition in the commerce involved.

Named as co-conspirators were:

Dominion Rubber Co., Ltd., of Montreal, Quebec, Canada, the voting stock of which is owned by U. S. Rubber.

Hungarian Rubber Goods Factory, Ltd., of Budapest, Hungary, one of the largest manufacturers of rubber products in that country.

Anode Rubber Co., Ltd., with headquarters on the Island of Guernsey.

Societa Italiana Pirelli of Milan, Italy, one of the largest producers in Europe.

International Latex Processes, Ltd., London, England, stock of which is owned principally by the three defendants and co-conspirator Pirelli.

Lastex Yarn and Lactron Thread, Ltd., London, England.

Canadian Lastex, Ltd., Montreal, Canada.

Pirelli-Revere Societa Italo-Americana Filo Elastico, Milan, Italy.

Emerge-Revere Thread Co., Ltd., Budapest, Hungary.

Emerge-Revere Braad Maatschappij, The Hague, Holland.

Thread Holdings, Ltd., and Guernsey Elastic Thread Co., Ltd., companies organized under the laws of the Island of Guernsey.

Societae Internationale de Fils Elastiques, also known as SIFE, which was organized in 1933 and until its liquidation in approximately 1936, existing under the laws of France with headquarters in Paris.

Societe Europeane De Fils Elastiques, also known as SEFE, which was organized under the laws of France.

Use of Mine Detectors

In recent months many rubber manufacturers in this country have complained of finding metal materials in bales of natural rubber shipped from Malaya, including some bales transhipped through London. Investigation revealed that in some cases bales had been bound with metal strips and then additional rubber wound around the outside. Because of this method of packing, it was difficult to discover the metal strappings before the rubber was placed in process. To counteract this possibility, all rubber on the London docks is now being checked with mine detectors before being shipped to this country.

LABOR NOTES

As a result of recent negotiations, employees of the Seiberling Rubber Co. with 15 or more years of service will receive three weeks vacation in the future. The first of these vacation periods for long-service employees was granted by Goodyear last June.

Hewitt Rubber Division of Hewitt-Robins, Inc., announced on December 6 that it was laying off some workers because of a year-end, seasonal drop in incoming orders. The over-all employment reduction affected less than 10% of the company's total Buffalo employment of about 1,200 workers.

Swan Rubber Co., Bucyrus, Ohio, laid off about 100 workers early in December. In a letter to employees the company stated that shipments of garden hose would be curtailed after January 1 due to "large warehouse inventories, uncertain economic conditions, and inventory taxes in many states."

COMMODITY EXCHANGE REVIEWS 1948 NATURAL RUBBER ACTIVITY

Crude natural rubber was at a lower price level throughout 1948 than the post-war price fixed by government control. In this respect it stands alone among the more important raw materials of American industry, according to a statement issued by a spokesman for the Commodity Exchange, Inc., at the year-end.

Spot price on No. 1 ribbed smoked sheets for New York delivery was at the year's peak of 25 cents per pound in late July and at the year's low of 18 cents at the end of November. Crude rubber came back into private business channels in the United States April 1, 1947. From January 1, 1947, until decontrol, the OPA ceiling price for No. 1 ribbed smoked sheets at Nw York was 25¾ cents per pound.

In the last days of November, 1948, and through the first two weeks of December, natural rubber price was below the 18½ cents per pound charged by the government for American-made synthetic rubber.

"These lower prices," trade interests pointed out, "were maintained despite rubber consumption by industry in the United States far above pre-war levels. The reason for them are three fold: (1) crude rubber production in the Far East ran ahead of expectations, (2) Europe and the rest of the world consumed less rubber than in pre-war years, and (3) American-made synthetic rubber production ran higher than was expected."

These three factors operated to fill industrial and trade pipe-lines and left enough over for the American government to increase materially its stockpile of the commodity for national safety. Most other industrial raw materials were still in short supply in 1948 and prices were well above OPA levels.

Trading in crude rubber futures in New York increased sharply during the year to a total of approximately 22,000 contracts of 10 long tons each, from 13,678 contracts in 1947. Most of this trading, according to the Exchange spokesman, was of domestic origin but some came from many foreign lands. Foreign trading in the New York market, it was noted, was a mere fraction of pre-war volume, due, it was asserted, to inadequacy of dollar exchange in most lands.

A second crude rubber futures contract was introduced to trading on the Exchange October 11. Designated No. 1 R.S.S., it permits delivery only of No. 1 grade ribbed smoked sheets. The older standard contract permits delivery of No. 1 grade and three other grades of smoked sheets. Trading volume in the No. 1 contract quickly outstripped trading in the standard contract.

RUBBER TECHNOLOGY COLLEGE NOW ORGANIZED IN ENGLAND

A National College of Rubber Technology has now been established in the Northern Polytechnic, London, England, and a Board of Governors has been appointed by the British Minister of Education on the nominations of various associations and educational interests. The Director of the college, under whose general supervision the head will work, is Dr. T. F. Drakeley, Principal of Northern Polytechnic, and well known in the rubber industry.

The establishment of the college is said to represent an important step forward in the organization of facilities for the training of technologists for the rubber industry. The establishment of the college is part of a general move by the Ministry of Education to assist in the improvement of facilities for technological training and research at the highest level for a number of specialized industries of great economic importance.

The general type of work to be done in the National College of Rubber Technology is as follows: (1) Full-time courses leading to the Associateship of the Institution of the Rubber Industry and similar qualifications; (2) Full-time post-graduate courses; (3) Full-time courses in research, some of which may lead to higher university degrees; (4) Sandwich courses; (5) Vacation courses; (6) Short full-time courses in specialized subjects; (7) Research work by the staff and qualified students, together with such other types of work as the governing body may from time to time determine.

The college will take over the facilities for training and research in rubber technology already provided in the Polytechnic.

Abandoning Airship Institute

The Daniel Guggenheim Airship Institute, founded 16 years ago to study lighter-than-air problems under the direction of the University of Akron, at Akron, Ohio, will be abandoned in the near future. The University board of directors announced that it can no longer maintain the research center. University President H. E. Simmons recommended the closing of the Institute "sometime in 1949." He pointed out that the University had spent over $100,000 of its own money to keep the Institute open. While some of the engineering equipemnt of the Institute is obsolete, some of it will be transferred to the University where aeronautical engineering courses will continue.

Appoints New District Managers

The Chemical Division of the Goodyear Tire & Rubber Co. has announced two new appointments of district managers for the Boston, Mass., and Cleveland, Ohio, territories. John Hussey, associated with the Goodyear organization for 14 years, was named in the New England area, and E. J. Hill in the Cleveland district. Mr. Hill has been with Goodyear since 1945. Both men were formerly representatives of the Plastics and Coatings Department until the company created the Chemicals Division.

Coming Events

Jan. 18. Buffalo Rubber Group, Westbrook Hotel, Buffalo, N. Y.
Feb. 4. Chicago Rubber Group, Morrison Hotel, Chicago, Ill.
Feb. 11. Connecticut Rubber Group, Hotel Barnum, Bridgeport, Conn.
Feb. 18. Akron Rubber Group, Hotel Mayflower, Akron, Ohio.
Feb. 28-Mar. 4. A.S.T.M., Spring Meeting, Hotel Edgewater Beach, Chicago, Ill.
Mar. 7-18. American Toy Fair, New York, N. Y.
Mar. 11. Detroit Rubber Group, Detroit-Leland Hotel, Detroit, Mich.
Mar. 21-23. N.A.W.M.D., Annual Meeting, Stevens Hotel, Chicago, Ill.
Mar. 25. Boston Rubber Group, Somerset Hotel, Boston, Mass.
Mar. 25. Chicago Rubber Group, Morrison Hotel, Chicago, Ill.
Mar. 27-Apr. 1. American Chemical Society, 115th National Meeting, San Francisco, Calif.
Apr. 15. Akron Rubber Group, Mayflower Hotel, Akron, Ohio.
May 6. Detroit Rubber Group, Detroit-Leland Hotel, Detroit, Mich.
May 20. Chicago Rubber Group, Morrison Hotel, Chicago, Ill.
May 23-25. Rubber Division, A.C.S., Statler Hotel, Boston, Mass.
June 17. Akron Rubber Group, Outing.
June 24. Detroit Rubber Group, Detroit-Leland Hotel, Detroit, Mich.
June 27-July 1. A.S.T.M., 52nd Annual Meeting, Chalfont-Haddon Hall, Atlantic City, N. J.
Sept. 18-23. American Chemical Society, 116th National Meeting, Atlantic City, N. J.
Oct. 7. Detroit Rubber Group, Detroit-Leland Hotel, Detroit, Mich.
Oct. 10-14. A.S.T.M., West Coast Meeting, Fairmont Hotel, San Francisco, Calif.
Oct. 14. Boston Rubber Group, Somerset Hotel, Boston, Mass.
Dec. 9. Detroit Rubber Group, Detroit-Leland Hotel, Detroit, Mich.
Dec. 16. Boston Rubber Group, Somerset Hotel, Boston, Mass.

American Hose and Rubber Co.

Details as to the formation of the American Hose and Rubber Co., 619 North 35th St., Seattle, Wash., have recently become available. The firm was organized approximately six months ago for the manufacture of air duct hose. The company operates as a partnership under the control of A. P. Hartson and R. G. Bringolf, both of whom were formerly associated with the American Ventilating Hose Co. in Seattle.

Cisney Leaves Schrader Firm

William R. "Bill" Cisney, assistant general sales manager of the A. Schrader's Son Division of the Scovill Manufacturing Co., Inc., has resigned from that organization. He has been associated with the Schrader organization in a sales capacity since leaving college in 1922. Widely known in the rubber and automotive fields, Mr. Cisney has not as yet announced any new connection.

OCTOBER CASING SHIPMENTS SHOW DECLINE OF 4 PERCENT

Manufacturers' shipments of passenger casings in October totaled 5,275,505 units, a reduction of 4.62% from September when 5,530,848 casings were shipped, the Rubber Manufacturers Association indicated in its regular monthly report. Shipments of bus and truck casings, however, gained somewhat in October with 1,216,021 units shipped as against 1,169,488 shipped in September. Total casings shipped in October amounted to 6,750,300 units compared with 6,700,336 units in September.

A total of 6,750,300 casings were produced during October. Of these, 5,560,088 were passenger casings, and 1,190,212 were truck and bus casings. In September a total of 6,914,526 casings were produced. Of these, 5,740,418 were passenger casings and 1,174,108 were truck and bus casings. Manufacturers' inventories stood at 9,905,263 casings on October 31 compared with an inventory of 9,805,223 units at the end of September.

A total of 6,323,006 passenger and bus and truck tubes were produced in October against the 6,191,462 units produced in September. Tubes shipped in October amounted to 6,060,516 units, while 6,200,044 units were shipped in September. As of October 31, 8,915,443 tubes were on hand compared with the 8,778,449 tubes on hand at the end of September.

Combine Research Facilities

The Jefferson Chemical Co., Inc., New York City, has announced plans for the consolidation of company research facilities at a site inside the city limits of Austin, Texas. Research, process and pilot plant activities are now being carried on in New York City and Port Arthur, Texas. The Austin site was selected due to its proximity to the University of Texas which offers excellent library and educational facilities. The property chosen comprises 69 acres and includes 5 buildings on 7 acres of improved land. An initial staff of approximately 65 persons will be employed at the installation as soon as remodeling is completed. Jefferson Chemical was formed in 1944 and is jointly owned by the Texas Co. and the American Cyanamid Co. Its major products are ethylene glycol, ethylene oxide and ethylene dichloride.

New Endicott Johnson Officers

George W. Johnson has resigned his position as president of the Endicott Johnson Corp., Endicott, N. Y., and was elected chairman of the board in a recent reorganization following the death of George F. Johnson, founder of the company. Charles F. Johnson, Jr., formerly vice-president and general manager, was elected president, and retained the general managership. Frank A. Johnson, a son of George W., was named vice-president. The new chairman of the board, in stepping down as president, said he had worked for the company for fifty years and no longer wished to put in full time, and so that promotions might be made in the interests of the company.

INDUSTRY HEADS FORECAST INCREASED SALES IN COMING YEAR

Rubber company executives in their annual year-end statements were in general agreemnt as to a favorable outlook for production and sales during 1949. Herbert E. Smith, newly-elected chairman of the U. S. Rubber Co., stated that the sales volume of the rubber industry in 1949 probably will total $3,500,000,000. P. W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., estimated another 1,000,000-ton year for the industry. John Collyer, president of the B. F. Goodrich Co., said that the industry can expect to sell approximately 2,000,000 more tires in 1949 than in 1948. The president of the General Tire & Rubber Co., William O'Neil, stated that the industry will make more pounds of tires in 1949 than it did in the previous year.

Mr. Smith said that four major influences are at work to keep business at a high level. These are: full employment at high wages, heavy government expenditures to finance defense and ECA programs, large expenditures by manufacturers and other business groups for expansion and modernization, and continued shortages in some durable lines accented by Government purchases.

According to Mr. Smith, approximately 83,600,000 tires were sold in the United States during 1948. Although this is a drop from the all-time high record of 97,500,000 units in 1947, it is far above the 58,900,000 total produced in the typical pre-war year of 1939. Tire sales during 1949, said Mr. Smith, will equal those of 1948.

Rubber Consumption in U. S.

Rubber consumption in the United States for 1948 was estimated at 1,075,000 tons by Mr. Smith, of which 625,000 tons was natural rubber and 450,000 synthetic. This is a slight drop from the 1,122,000 tons used in 1947. It was estimated that the United States in 1948 consumed 56% of all the rubber consumed in the world. Per capita consumption in this country is 17 pounds, ten times the average for the world.

The most important rubber development of 1948 was the introduction of synthetic "cold rubber," said Mr. Smith. By July, 1949, it is expected that synthetic plants will be turning out the new rubber at the rate of 183,000 tons a year, about one-half the total production of general purpose synthetic rubber in the United States.

Foam rubber production, which has been greatly expanded since World War II, will be increased further in 1949 to meet the growing demand for foam mattresses and cushioning. Industrial rubber products, including hose, belting, packing and vibration-dampening devices, will be in strong demand in 1949, said Mr. Smith.

Production of golf balls, bathing caps, druggist sundries and other miscellaneous rubber products was substantially above the prewar level in 1948 and this pattern is expected to continue through 1949. Increased sales are also in sight for Lastex yarn due to the growing popularity of elastic fabrics.

Mr. Litchfield noted in his statement that the rubber industry's statistical data for the three post-war years discloses a rapid peacetime conversion in 1946, the soaring of tire produtcion to an all-time high in 1947 and the levelling off to a more normal market in 1948. For the third consecutive year rubber consumption in the United States during 1948 exceeded 1,000,000 long tons.

Mr. Litchfield estimated passenger tire production for the year at 67,400,000 compared with 77,800,000 in 1947; truck and bus tires at 14,600,000 against 17,800,000 a year earlier, and farm tires at about the 1947 level of 5,100,000. Total new rubber consumption for 1948 was estimated at 1,070,000 long tons.

Passenger tire replacement sales, wholesale, fell off sharply during the year as did truck and bus and farm tire replacements due to the building up of adequate dealer inventories, observed Mr. Litchfield. Original equipment sales, however, increased in both passenger car and farm tire markets, and original equipment sales of truck and bus tires approximated last year's figures.

Compared with 1946, passenger car tire original equipment sales doubled in 1948, farm tire original equipment sales had increased over 50% and, similarly, truck and bus tire sales were 25% greater. During the three post-war years beginning with 1946, total passenger car tire replacement sales have approximated 149,000,000 or 5.6 tires per vehicle for the 26,500,000 passenger automobiles and light trucks which were on the highways and were more than two years old in 1948.

The ratio of natural rubber to total new rubber used during 1948 rose to 58% against 42% for synthetic. Last year the ratio was about 50-50 and in 1926 only 27% natural rubber was used against 73% synthetic, said Mr. Litchfield.

Although tire dealer inventories currently are on the high side, the rubber industry looks forward to 1949 as another possible 1,000,000 ton year. Further declines in replacement tire sales are anticipated but original equipment sales are expected to hold up well. Truck and bus original equipment tires are expected to level off, he said.

With belting and other mechanical goods continuing at a high rate of production, and the increasing use of Airfoam, Pliofilm, rubber flooring, vinyl and chemical products, the coming year in the rubber industry should compare favorably over-all with 1948, Mr. Litchfield concluded.

Higher Plateau of Activity

In his statement, John L. Collyer said that total industry sales for 1948 are now estimated at 84,000,000 tire units and, barring unforeseen events, should reach 86,000,000 in 1949. He pointed out that in the pre-war peak year of 1940 industry sales amounted to 60,622,000 units and that even in 1941, when the defense program boosted production and sales, units totaled only 68,979,000. Tires, tubes and tire products, he added, account for about 70% of the total rubber consumption.

The industry has consumed 55% more rubber in the three years since V-J Day of 1945 than it did in the three previous peak years added together, he said. The comparison, Mr. Collyer explained, illustrates the fact that the American rubber industry has moved onto a "higher plateau of activity" in the post-war era. This is clearly no aftermath of the war, he said, because it has been almost a year since the backlog of demand caused by the war ceased to be a major factor, so far as tires are concerned.

Another factor in the substantial advance of annual rubber consumption to higher levels than even those of the "big" years just preceding the war is the use of more and larger tires on trucks, buses and farm vehicles. The average tire weight has increased more than 20% in the last 10 years.

Mr. Collyer predicted that during 1949 there will be a continuing increase in the use of rubber for industrial applications. He said that in addition to the trend toward using rubber conveyor belts for all types of material handling jobs, rubber is being employed mechanically by industry in many non-transportation roles. The demand for rubber footwear, heels, soles and other shoe products is expected to be below the post-war peak but substantially above the pre-war level.

Weather an Important Factor

William O'Neil observed that the weather this coming summer will have a great deal to do with eventual tire sales. He explained that an abnormal 20-day summer heat wave, for instance, brings automobiles onto the highways in great numbers, the motorists' mileage mounts, and the demand for tires could easily soar by 25%, or even greater.

Low pressure tires, said Mr. O'Neil, mean greater tire poundage, since the popular 6.50 x 16 tire, for instance, when replaced by the low pressure 7.60 x 15, adds some five pounds to the tire weight. The industry too, will be called upon to meet the requirements of the trucking industry, which figures to have the greatest year in its history, he said. In all, from the sales standpoint, Mr. O'Neil predicted a normal slow first quarter, but meeting the anticipated poundage requirements should add up to another good year for the rubber industry.

Schoales Named Texon President

At a regular meeting of the board of directors of Texon, Inc., immediately following the annual stockholders meeting held in Boston, Mass., recently, David R. Schoales was advanced to the presidency. He succeeded Morgan J. Vittengl, who became chairman of the board. J. Warren Heffner was elected vice-president in charge of sales.

Form Process Industries Co.

Process Industries Engineers, Inc., was recently formed in Pittsburgh, Penna., for service to the chemical industry and processing field. The company has announced its plan to integrate two complementary services: First, the sale of equipment of manufacturers where engineered applications are satisfactory; and second, the design and fabrication of equipment where special designs are necessary. The company will specialize in the field of interrelated unit process operations, which include material storage, handling, fluid movement, mixing and agitation, reduction and separation, and in impregnation, vulcanization, etc. W. W. Calihan, who recently resigned as director of sales and advertising of the H. K. Porter Co., Inc., Pittsburgh, Penna., is vice-president of the company.

Moldex Rubber Still Active

An item in our previous issue referred to the fact that the machinery and equipment of Johnson-Moldex, Inc., at Philadelphia, Penna., was to have been disposed of at public auction on December 9. It has since been called to our attention that the Moldex Rubber & Plastics Corp. was in no way connected with or any part of Johnson-Moldex, Inc., despite the use of the name "Moldex" in both corporate titles. The Moldex Rubber & Plastics Corp., of which L. K. Braunston is president, is still actively engaged in the business of furnishing molded and extruded rubber and plastics, with offices at 1 East 57th St., New York 22, N.Y., with warehouses in New York City and elsewhere. We are glad to call this fact to the attention of our readers.

Consumption Rises in November

The consumption of rubber during the month of November was estimated at 89,378 long tons, about 1½% higher than in October when 88,028 tons were consumed, the Rubber Manufacturers Association reported recently. Consumption of natural rubber during the month of November was up 3.71% to 51,569 tons, as compared with 49,723 tons the previous month. November consumption of synthetic rubbers declined slightly to 37,809 tons from the 38,305 tons consumed in October, a reduction of 1.30%. The report estimated consumption of reclaimed rubber in November at 23,310 long tons, slightly higher than the October consumption of 22,959 tons.

Appointed Agent for Pliobond

The Chemical Division of the Goodyear Tire & Rubber Co. has announced the appointment of W. J. Ruscoe and Co., 2170 West Market St., Akron, Ohio, as distributors for Pliobond. Associated with Mr. Ruscoe in the enterprise are E. A. Filley and R. M. McPherson. All are former Goodyear personnel, closely associated with the development of Pliobond. The Ruscoe company maintains warehouses in Akron and Cleveland, Ohio.

Williams Named General Manager

Selden T. Williams

The Scovill Manufacturing Co., Inc., has announced the appointment of Selden T. Williams, vice-president of the company, as general manager of A. Schrader's Son Division, Brooklyn, N. Y. Mr. Williams joined A. Schrader's Son in 1929, and was appointed vice-president of Scovill in 1944, in charge of manufacturing of Schrader foreign and domestic plants. Mr. Williams was graduated from St. Lawrence University with a B.S. degree in 1913 and earned his Master's degree there in 1926. He received his B.S. degree in mechanical engineering at Worcester Polytechnic Institute in 1916. He joined the Naval Aircraft Factory, Philadelphia, Penna., in 1917 as assistant experimental engineer, and later was assistant chief engineer. In 1922 he went with the Victor Talking Machine Co., Camden, N. J., where he worked up from assistant chief draftsman to general superintendent and works manager in 1927. He left there in 1929 to join Schrader. Mr. Williams is the author of the "Automobile Repairman's Helper," and many technical articles. He has many inventions to his credit including the Airplane Fairlead used on military aircraft. He is a member of many technical and fraternal societies, including the Society of Automotive Engineers.

De Laney Leaves Faultless

Wallace De Laney, chairman of the board, president, and director of the Faultless Rubber Co., Ashland, Ohio, tendered his resignation from all three offices at a board of directors' meeting on December 17 in Ashland. Mr. De Laney was succeeded by T. W. Miller, Jr., formerly a vice-president and director of the company, and the oldest son of the founder of the company. Mr. De Laney will devote his time to research and development projects in connection with the rubber industry, and to consulting services for rubber companies generally.

Filtration Engineers, Inc., Newark, N. J., has announced production of new filter fabrics of heat resistant Vinyon-N which are especially recommended when resistance to acids is involved.

Auction Casto Company Assets

In accordance with an order issued by a referee in bankruptcy in Columbus, Ohio, the assets of the Casto Manufacturing Co. will be offered at public auction beginning January 25, 1949, at 10:00 A.M., at Parkersburg, W. Va., and continue on January 26, at 10:00 A.M., at Marietta, Ohio. Real estate together with machine shop equipment, rubber and plastics machinery, factory supplies, and finished and unfinished inventory will be offered at both sites. The equipment includes mills, mixers, presses, pumps, accumulators, curing ovens, extruders, etc., and will be offered in bulk, units and piecemeal lots. All sales are subject to confirmation by the referee at Columbus. Rosen & Co., NBC Building, Cleveland, Ohio, will conduct the auction.

Form Manufacturing Division

The creation of a new central manufacturing division has been announced by the Minnesota Mining and Manufacturing Co., St. Paul, Minn. Dr. Byron J. Oakes, associated with the company since 1928, has been named general manager of the new unit. The division will begin operations by coordinating the activities of the National Synthetic Rubber Corp., a subsidiary company located in Louisville, Ky., and those of the Special Products Division in St. Paul. Dr. Oakes is a native of Michigan, attended Michigan State Normal College and received his Ph.D. degree from Columbia University. For the past five years Dr. Oakes has been general manager of the National Synthetic Rubber Corp.

Litchfield Honored by Industry

A testimonial luncheon commemorating his fifty years of service in and to the rubber industry was tendered to Paul W. Litchfield, chairman of the board of the Goodyear Tire & Rubber Co., in New York City on December 18. Held at the Union League Club, the luncheon was marked by the attendance of more than a score of prominent rubber officials. Mr. Litchfield was awarded a sterling silver cigar box from his associates on the board of directors of the Rubber Manufacturers Association, the presentation being made by A. L. Viles, president. Mr. Litchfield started his career with L. C. Chase & Co., a small bicycle tire firm in Reading, Mass. He joined the Goodyear organization in June, 1900.

Synvar Expands Sales Activities

The Synvar Corp., Wilmington, Del., in a general expansion of sales activities, has announced the appointment of new sales agents including the C. P. Hall Co., which will have general coverage for the sale of Synvar resins from central New York to the West Coast. The T. C. Ashley Co., Boston, Mass., will specialize in the introduction of resins to the rubber trade in New England, and Harrisons and Crosfield, Inc., will handle sales in Greater New York City, Northern New Jersey, and Eastern New York State as far west as Rome, N. Y.

SMITH AND HUMPHREYS HEAD UNITED STATES RUBBER COMPANY

Herbert E. Smith, formerly president of the United States Rubber Co., and Harry E. Humphreys, Jr., formerly vice-president and chairman of the finance committee, were recently elected chairman of the board and president, respectively. Mr. Smith, in addition, will act as chief executive officer of the company, while Mr. Humphreys will also be chairman of the executive committee. F. B. Davis, former chairman of the board and chief executive officer for the past 20 years, has retired, but will continue as a director of the company and a member of the finance committee.

At the same meeting, Arthur Surkamp, treasurer, was elected vice-president and chairman of the finance committee, as well as a director and a member of the executive committee. Herbert M. Kelton, general auditor, was elected treasurer.

Data on Mr. Smith

Mr. Smith was born in San Jose, Calif., in 1889, and was educated at the University of California. He joined U. S. Rubber in 1913 as a mechanical goods salesman, and in 1924 he was appointed general manager of United States Rubber Export Co., Ltd. One year later he was appointed general manager of the company's general division, which included all products except tires, and in 1926 was promoted to the second vice presidency.

Mr. Smith's election as director and vice president of the parent company in charge of sales and distribution was voted in 1929. On January 1, 1942, he was made vice-chairman of the executive committee, succeeding to the presidency on September 28 of that year when F. B. Davis, Jr., relinquished the office. Mr. Smith is a director of many companies and is a member of various technical and fraternal organizations.

Biography of Mr. Humphreys

Harry E. Humphreys, Jr., the new president, was born in Philadelphia, Penna., in 1900 and was educated in the public schools of that city. After a period with the Pennsylvania Railroad, Mr. Humphreys joined the Toledo Scale Co. In 1922 he joined the Alan Wood Iron and Steel Co., and in the same year enrolled in the Wharton School of Finance of the University of Pennsylvania, attending evening classes.

In 1927, Mr. Humphreys joined the Christiana Securities Co., Wilmington, Del., finally becoming secretary and assistant treasurer of the company. In 1938, he was elected a vice-president, director and member of the finance committee of U. S. Rubber. In 1942, he was elected chairman of the finance committee and vice-chairman of the executive committee.

Sketches of Other Officers

Arthur Surkamp was born in St. Louis, Mo., in 1893, and was graduated from the University of Texas in 1913. A year later he received his LL.B. from the same institution. He practiced law for two years and then entered the Harvard Graduate School of Business Administration where he studied for one year. He joined U. S. Rubber in 1919 after a period of service with the U. S. Army.

Mr. Surkamp organized the company's first employment office in New York, and was eventually promoted to assistant cashier of U. S. Rubber Plantations, Inc. Later, he became assistant to the comptroller of U. S. Rubber, and in 1929 was elected comptroller, a position he held until 1940, when he was elected treasurer of the company upon the consolidation of the two activities.

Herbert M. Kelton was born near Haddonfield, N. J., on July 30, 1902. He attended the public schools of Haddonfield and the University of Pennsylvania. Mr. Kelton started his business career in 1922 as a clerk in the Chatham and Phenix National Bank of New York, and later in the same year became bookkeeper and office manager in the offices of Pencil Points Press, Inc. In 1923 he became a junior accountant with the public accounting firm of Haskins and Sells.

Mr. Kelton began his career with U. S. Rubber on April 24, 1929, as manager of the audit section in the comptroller's department. One year later he was appointed assistant comptroller. He was made general auditor of the company in 1940. He has been a certified public accountant in New York State since 1936 and is a member of the American Institute of Accountants.

Isopol Resin in Production

The Union Bay State Chemical Co., Cambridge, Mass., has announced that its Isopol Resin is now in pilot plant production. The material, an original development of the company, a brief description of which appeared in our March, 1948, issue, is a hydrocarbon resin with moderately high molecular weight, made up of approximately 75 parts of styrene and 25 parts of isoprene. It is best described as a modified polystyrene in which the isoprene acts as an internal plasticizer. It possesses many of the chemical properties of rubber and is unique in that it is completely soluble in petroleum naphtha. According to the company, it appears to offer some very definite advantages in various applications where estergum, para-coumarone-indene and terpine resins are now used. Isopol resin may be used in a solution, in an emulsion. or as a solid.

Industry Mobilization Plans

Plans for the mobilization of the rubber industry have recently been set afoot by the National Security Resources Board for use in a possible emergency. The aim of the project is to prepare procedures and an organization that will make possible rapid conversion to war production should the need arise, and to make maximum use of the industry's resources under mobilization conditions. A sub-committee of the rubber advisory committee of the Munitions Board, at a meeting with the NSRB, has undertaken the initial planning phase. William T. Hack, director of the NSRB rubber and chemicals division, presided over the opening conference. Other participants included: Paul Terrat (O'Sullivan Rubber), J. Ward Keener (Goodrich), Harvey S. Firestone (Firestone), G. M. Tisdale (U. S. Rubber), and Harry E. Smith (Raybestos-Manhattan).

Baldwin Named Representative

The Meyer & Brown Corporation, dealers in natural and synthetic rubber, with headquarters at 347 Madison Ave., New York 17, N.Y., has announced that Charles M. Baldwin has been appointed mid-western representative of that organization. Mr. Baldwin is also Chicago district manager of the United Carbon Co. and in addition represents the Southeastern Clay Co. and the Adamson-United Co. in that area.

Herbert E. Smith
Chairman

Harry E. Humphreys, Jr.
President

Arthur Surkamp
Vice-President

Herbert M. Kelton
Treasurer

Study of Reinforcing Blacks

The B. F. Goodrich Chemical Co., Cleveland, Ohio, has been conducting a study of a number of rubber chemicals to find a possible solution to the scorching problem which is prevalent with reinforcing furnace blacks. According to the company, Good-rite Erie, the delayed action accelerator, and Good-rite Vultrol, an effective retarder at normal processing temperatures, both made by the company, have been successfully combined under test conditions in a tread formulation in which adequate freedom from scorch has been achieved and the inherent advantages of reinforcing furnace black realized without detriment to other important compound properties. Further details are available from the company.

McNeil Buys Cleveland Crane

McNeil Machine and Engineering Co., Akron, Ohio, has taken over the Cleveland Crane and Engineering Co. by acquiring more than 90% of its capital stock. The two firms will be merged under the name of the Akron company. Cleveland Crane will be known as the Cleveland Crane Division of the McNeil Machine & Engineering Co. Cleveland Crane personnel will continue to operate the new division. The purchase came as a climax to almost two years of negotiations.

Bliss Buys Interest in Sheller

The Sheller Manufacturing Corp., Portland, Ind., has announced the sale of 62,500 shares of previously unissued common stock to E. W. Bliss Co., Detroit, Mich. The price was sixteen dollars a share. Sheller will apply the proceeds to the redemption at par of $1,000,000 of its 5% cumulative preferred stock. Bliss had previously purchased 24,200 common shares of Sheller in December, 1947. Prior to this transaction, Sheller had 490,840 common shares outstanding out of 800,000 authorized.

Form Koppers Pittsburgh Co.

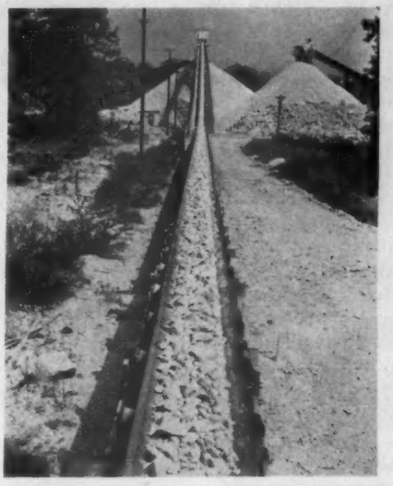
Koppers Co., Inc., and the Pittsburgh Plate Glass Co. have announced that Koppers Pittsburgh Co., a new Delaware corporation in which each owns 50% of the outstanding stock, has taken title to the phthalic anhydride plant at Kobuta, Penna., The plant was originally operated by Koppers Chemical Division. Recently, Koppers completed an addition to the Kobuta plant. Under present operations, the Chemical Division will continue to operate the plant for Koppers Pittsburgh.

Grafton Joins Tompkins Rubber

Dr. E. Harley Grafton, chief chemist of the West Company since 1923, has left that organization and has joined the Tompkins Rubber Co., of Conshohocken, Penna., as chief chemist and head of the analytical and research laboratory. Prior to joining the West Co., Dr. Grafton was associated with various concerns in the rubber field, including Goodyear, Manhatttan Rubber, Quaker City Rubber, Murray Rubber, Vulcan Proofing, Kenyon Tire, and the Electric Hose & Rubber Co.

Seven Mile Conveyor Belt

The most spectacular operational phase in the construction of the $58,000,000 Bull Shoals Dam on the White River near Flippin, Ark., is the transportation of aggregate for use in making concrete.



The aggregate travels seven miles over both rough and flat country on a compounded rubber and cotton fabric conveyor belt designed and built by the Goodyear Tire & Rubber Co. The 30-inch belt in 21 flights is delivering 650 tons of crushed rock an hour at the dam site. Belting for the job as furnished by Goodyear totaled more than 74,000 feet for the main haul and 14,000 feet for terminal handling.

Plan Symposium on Aging

Sub-Committee XV of Committee D-11 on Rubber and Rubberlike Products of the American Society for Testing Materials will present a Symposium on the Life Aging of Rubber and Synthetic Elastomers during the Spring Meeting of the Society to be held at the Edgewater Beach Hotel in Chicago, Ill., from February 28 to March 4. The committee arranging the symposium consists of G. C. Maassen (Vanderbilt) as chairman, and the following: H. E. Outcault (St. Joseph Lead), R. D. Stiehler (Bureau of Standards), L. V. Cooper (Firestone), L. E. Cheyney (Waterproof-Ohio Paper), A. E. Juve (Goodrich), T. A. Bulifant (Barrett), H. E. Charles (Hazard Insulated Wire), M. G. Schoch, Jr. (Hewitt Rubber), and G. A. Wilson (A.S.T.M.). Further details on the symposium will be published in our next issue.

Suit Against Bell Pending

The Justice Department is studying the advisability of launching a civil anti-trust suit against the Bell Telephone System to force divestment of the Western Electric Co., its manufacturing subsidiary. Department sources said the study involves the connection between the American Telephone & Telegraph Co., parent company of the Bell System, and Western Electric Co., which manufactures all the telephones and equipment needed by the Bell companies. Some Justice Department lawyers contend this gives Western Electric a practical monopoly on the telephone equipment industry.

Puncture-Proof Compound

A new tire compound designed to overcome the problem of punctures has been developed by Professor J. R. W. Young, head of the Department of Agricultural Engineering at the University of British Columbia. The compound is described as a pliable material with an asbestos base and is blown into the tube through the valve stem. The centrifugal motion of the wheels whirls the material around inside the tube, distributing the compound underneath the tread and an inch up the sidewalls. In one experiment, a tube leaking at the rate of 2 pounds a day was treaated with the new compound. It was then inflated to 31 pounds pressure and maintained this pressure in use on a passenger car for 45 days.

Pirelli Opens N. Y. Office

The internationally-known firm of Pirelli, manufacturers of electric cables and rubber products in general, has appointed N. Baseggio as its New York representative and has established an office at 11 West 42nd St., New York 18, N. Y. Mr. Baseggio will act as liaison officer for both Pirelli Milano and Pirelli Basel, as well as their respective affiliated companies, in connection with purchases and other business contacts in the United States. The telephone number of the New York office is BRyant 9-2594.

New Schedule For Exporters

The Bureau of the Census, Department of Commerce, has announced a new edition of Schedule B, commodity classifications for exporters and others concerned. The new schedule went into effect on January 1, 1949. The new Schedule B may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., at a cost of $2.50 for Part One, which is an alphabetical index, and $1.50 for Part Two, which is a numerical index of commodity numbers.

Mineral Pigments Sales Office

The Mineral Pigments Corp., Muirkirk, Md., has announced the opening of a midwest district sales office at 629 West Washington Boulevard, Chicago 6, Ill., with James H. Devine as district sales manager. This addition to the company's sales offices follows upon the considerable expansion the corporation has made in their main plant at Muirkirk in the manufacture of synthetic iron oxides, chromium oxide green, chrome colors, special carbon and lamp black pigments, etc.

Teac-90 Emulsion Stabilizer

Consulting Research Associates, 6 Newbury St., Beverly, Mass., has announced the development of Teac-90, an emulsion stabilizer which functions as a color stabilizer and corrosion inhibitor, and which is said to possess good dispersing action. Teac-90 is a clear, syrupy liquid, soluble in water and in some alcohols. It has a slight alkaline reaction, and is stable to dilute acids and alkalis. The product finds use in latex, synthetic and natural resin emulsions, shoe dressings, coatings, etc.

RUBBER ASSOCIATION REVIEWS 1948 ACTIVITIES IN SPECIAL REPORT

Solid evidence of broad, continuing markets for rubber products throughout 1948 is found in the production records set by the industry, according to a special year-end report issued by the Rubber Manufacturers Association. The report indicated that these markets were far greater and stronger than anything which had been envisaged in the early post-war period when virtually all extraordinary production was attributed to the backlog of deferred demand.

The industry's consumption of new rubber topped the million-ton mark for the third consecutive year. Rubber consumption totalled an estimated 1,075,000 long tons, as compared with 1,039,000 long tons in 1946 and 1,122,000 long tons in 1947. For the decade prior to 1939 annual consumption averaged less than 500,000 tons a year. Usage thus appears at the postwar rate to bear out a historic trend to double in each decade. Present forecasts indicate that rubber consumption during 1949 will be nearly as large as in 1948.

Production of end products, valued at an estimated 3½ billion dollars and covering some 50,000 different items, reflected this high rate of rubber consumption throughout the industry.

In the case of passenger car tires, output totalled an estimated 67,000,000 units, down 10 million from the year before, but ahead of 1946 and far in front of the 50,900,000 casings produced in 1940 which long stood as the biggest of the so-called "normal" peacetime years. Truck and bus tire production totalled 14,700,000 units as against 17,754,000 in 1947, 15,832,000 in 1946, and an average of well under 10 million prior to the war. Truck, bus and passenger car tube production was 72,000,000 units, down 7 million from a year ago.

Long-Term Trend Evidenced

The long term trend toward increased consumption of rubber both in existing and new products continued in virtually all lines. This was notably true in mechanical rubber goods and in the rapidly growing field of latex foam products. To a greater or lesser degree, this trend prevailed in such other lines as rubber footwear, rubber drug sundries, hard rubber goods, rubber flooring, rubber coated materials and others. Nor was there any apparent interruption in the long term trend toward the replacement by rubber of certain competing materials such as, for example, leather, steel and textiles, in such applications as footwear, containers and conveying mechanisms and in garments and coverings.

Spokesmen for the Rubber Manufacturers Association singled out as the outstanding development of the year in the transportation field its introduction in large scale production of the extra low pressure tire, claimed by the industry tire engineers to give greater comfort and a higher degree of road safety through greater contact area than any development in a generation.

The year marked substantial progress in the still growing field of man-made rubbers. There appeared in 1948 a number of new polymers of the so-called GR-S type which proved adapted to do specific jobs better than any raw materials heretofore available. One in particular was brought into production and by the year's end it was the talk of the industry.

The latter is the low temperature synthetic "cold" rubber, so-called because it is made at 41°F. as compared with other types which are polymerized at much higher temperatures. By late 1948 production of "cold" rubber was at an annual rate of 21,000 tons. In 1949 the Reconstruction Finance Corporation will increase capacity to 183,000 tons by extensive conversion of a number of its polymerization plants. This would have been equivalent to 47 percent of the total GR-S production in 1948.

Hailed as the best tire tread stock that has been developed, this rubber has given evidence in its first year of testing of being able to outwear previous tread stocks by as much as 30 percent. Because of its high resistance to abrasion, it is expected to find wide application in certain areas of the rubber mechanical goods field, particularly in belting. For the time being, at least, demand for "cold" rubber far outstrips available supply.

Just what impact the new rubber may have on the present use pattern, that is, on the proportion of synthetic and natural rubber consumed by the American industry, is a question that will be much closer to any answer a year hence after new production has become available. For 1948 the ratio was roughly three to two in favor of natural rubber. The industry consumed 625,000 tons of natural rubber and 450,000 tons of synthetic rubber. This was approximately 60,000 tons more natural rubber, and 110,000 tons less synthetic rubber than were consumed a year ago.

Significance of Figures

The significance of these figures, however, lies in the fact that 1948 synthetic rubber consumption represents a relatively high proportion of voluntary use. Except for the tire, tube and camelback makers, all segments of the rubber industry in this country were legally freed from mandatory use of synthetic rubber by amendment to the controlling government regulation dated September 9, 1947, and this policy was continued following adoption of the Rubber Act of 1948 which was enacted last March 31. This act requires the industry, in the interest of national security, to use a minimum of 225,000 tons of general purpose and special purpose synthetic rubber a year. Actual consumption doubled this in 1948, thanks in a large measure to voluntary demand for the American-made GR-S which was able for the first time to compete with natural rubber on a price-quality basis.

The year, at the same time, saw substantial improvement in natural rubber supply with the progressive restoration of producing areas in the Far East and particularly in the Netherlands East Indies. The natural rubber producing areas have a potential variously estimated at from 1,800,000 tons to 2,100,000 tons. With American-made rubber in the picture, new rubber supplies have been thus more than ample to meet the requirements of the manufacturing industry in this country and schedules set up for achieving the U. S. Government's security stockpiling program. As against the supply picture, world consumption of rubber was 1,735,000 tons in 1947. It has been estimated at perhaps as much as 1,900,000 tons in 1948.

In conformity with its long standing policy to maintain close, working cooperation with the administrative agencies of the government, the rubber manufacturing industry through its designated advisory committees devoted much of their time through the year to the Munitions Board, the Reconstruction Finance Corp., and the National Security Resources Board in implementing the security stockpiling program, in developing plans for the disposition of the government-owned synthetic rubber plants, and in developing plans for quick and effiicent industrial mobilization of plant capacity in event of an emergency.

Bakelite Expands Facilities

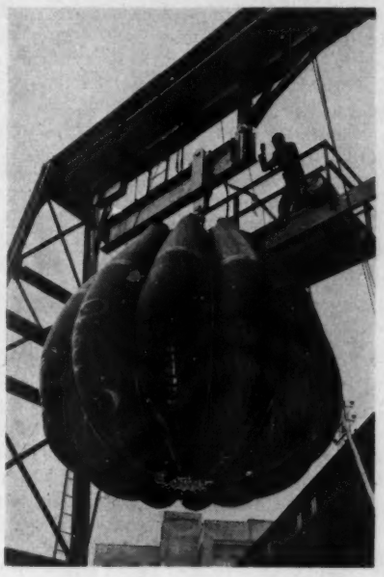
Expanded plastics manufacturing facilities have enabled the Bakelite Corp., a unit of the Union Carbide and Carbon Corp., to increase average productive capacity by approximately 50 to 60% during 1948. Further increases in plastics producing facilities, most of which are already well under way, will be completed during 1949 as part of the most extensive plant expansion program in the corporation's 38-year history. The expansion program includes the completion of an entirely new plant at Ottawa, Ill.; additions to facilities in South Charleston, W. Va.; Texas City, Texas; Bound Brook, N. J.; and new plants in West Bath, Me., and Belleville, Ontario, Canada. The entire program will enable Bakelite to maintain its position as one of the plastic industry's largest producers of vinyl plastics, polytheylene resins, and phenolic molding materials and other phenol-formaldehyde products.

Lee Rubber Opens Exhibit

Lee Rubber & Tire Corp., Conshohocken, Penna., recently opened an exhibit depicting rubber's role in industry at a special ceremony at the Franklin Institute, Philadelphia, Penna. Lee's panoramic display will be on permanent view at the Institute which has a 125-year history in the promotion of the "mechanical arts." A large circular room furnished in various types of rubber has been set aside by the Institute for the display. The exhibit has seven main divisions tracing the history of natural rubber, properties, sources of supply, synthetic products, tire manufacture, anatomy of a tire and production and uses of rubber in all industry.

Develop Salvage Pontoon

The melon-shaped pontoon in the accompanying illustration was designed by fabric engineers of the Goodyear Tire & Rubber Co., Akron, Ohio, is a salvage pontoon for the U. S. Navy. Shown here undergoing test, the huge pontoon is constructed of nylon cloth impregnated and spread with synthetic rubber compound.



It has a lifting capacity of 25 tons and its extreme lightness will enable one diver to attach it to a sinking or sunken submarine or ship. For testing purposes the pontooon is suspended upside down and filled with 25 tons of salt water. When in actual operation, it will be attached to the distressed vessel and inflated from surface pumps. Similar devices were used to keep damaged ships afloat during the Bikini atomic bomb tests last year.

Tire Production in Germany

Production of tires for automobiles and trucks in the Bizonal Area of Germany totaled 665,000 units in the first half of 1948 as compared with 395,000 units in the first half and 510,000 in the second half of 1947, according to the U. S. Department of Commerce. The total output of 905,000 in 1947 represented an increase over the 848,000 tires produced in 1946, but was far below the output of 2,724,000 in 1936. Production of bicycle tires totaled 2,694,000 units in the first six months of 1948 compared with 1,849,000 in the corresponding period of 1947, and 2,049,000 in the latter half of 1947. The output in 1946 was 3,952,000 bicycle tires, and in 1936 it was 29,448,000 tires.

Expands Underlay Facilities

The U. S. Rubber Co. has announced the expansion of manufacturing facilities for U. S. Rug Underlay, a sponge material for carpets and large rugs. When used under rugs the material provides insulation and non-skid features. The sponge material is 54 inches wide and may be cut to any shape or dimension with home scissors.

BUSINESS DIFFICULTIES

Effective with this issue, this column on "Business Difficulties" will appear from time to time covering petitions in bankruptcy, appointments of trustees, and other difficulties encountered by rubber manufacturing firms. The data for the column is being supplied by the Rubber Division of the National Credit Office, Inc., of New York. The following were recently reported:

CORDS, LTD., NEWARK, N. J.—S. Arthur Stern has been appointed trustee under Chapter X of the Bankruptcy Act. He was appointed after a petition filed by the company for a trustee under whose guidance a temporary cash shortage could be alleviated and a general reorganization of the company's affairs effected. Schedules filed list assets of $1,451,551 and liabilities of $960,094. A hearing relative to the appointment of a permanent trustee will be held on January 31.

KEATON RUBBER CO., INC., NEWARK, N. J.—Fred C. Von Hoff has been appointed receiver, following petition filed by the company on December 20, 1948, for reorganization under Chapter XI of the Bankruptcy Act. Schedules filed show total assets of $183,035 and total liabilities of $215,856. Reorganization plan advanced includes provision whereby creditors of $100 or less will be paid in full with other general unsecured creditors to receive 20% on March 15, 1949, and for four succeeding quarters through March 15, 1950.

CADILLAC CHEMICAL CORP., BOSTON, MASS.—Assigned on November 15, 1948, for the benefit of creditors to S. J. Kegan, of Boston.

Load Range of Instron Tester

An illustrated description of the new Instron testing unit recently developed and introduced by the Instron Engineering Corporation of Quincy, Mass., appeared in our October, 1948, issue. It has been called to our attention that we neglected to mention the load range of the instrument. The extended range of the Instron from spider-like materials at 2 grams full scale to heavy specimens breaking at 1,000 pounds is a feature of the instrument. It essentially incorporates into one machine five available instruments necessary to cover the range, in addition to features of precision, speed and flexibility. The company has recently further extended the high range from 1,000 to 5,000 pounds in a new model designated as Instron TTC. This load range represents a spread of approximately a million to one.

Expand Huber New York Office

The New York offices of the J. M. Huber Corp., at 342 Madison Avenue, have been expanded to include the office of the director of purchases and the finance and accounting departments of the corporation, formerly located at the Brooklyn, N. Y., plant. Moving to New York are Treasurer R. J. Cashion and his assistants, and Director of Purchases E. M. Krech. Purchasing office of the ink division will remain in Brooklyn under the direction of Charles Cubbison.

Rubber-Lined Tanks in Barges

A 58,400-gallon rubber-lined tank, largest ever built for installation in a river barge, is shown being lowered into the hold of the first of five specially designed barges

for carrying hydrochloric acid on the Intercoastal waterway and the Mississippi River and its tributaries. The Dravo Corp. at its Neville Island Shipyard, Pittsburgh, Penna., is building the vessels for the Texas Division of the Dow Chemical Co., Freeport, Texas. They are said to be the first vessels ever specifically designed and built for transporting hydrochloric acid.

Establishes Mellon Fellowship

The National-Standard Co. of Niles, Mich., has established an Industrial Fellowship at Mellon Institute in Pittsburgh, Penna., to investigate in a long-range program major problems related to the technology of fine wire products such as bead wire, strand for heavy duty tire casings, etc. Also to be studied are problems related to flat strip for use in such products as piston rings, razor blades, clock and watch springs, pen points and umbrella ribs. The Fellowship is headed by Charles T. Wilkins, formerly metallurgist with the Copperweld Steel Co. Mr. Wilkins was graduated from Virginia Military Institute wtih a B.S. degree in chemistry in 1942. Subsequently, he pursued advance work in metallurgy at the University of Pittsburgh, receiving his M.S. there in 1946.

Binney & Smith Subsidiary

Binney & Smith Co., New York City, has formed a subsidiary company to be known as Binney & Smith Co. International to handle the foreign business of the parent company. The sale of compounding materials, pigments and machinery for the rubber industry abroad will be handled solely by the new subsidiary. Norman Lee Smith, vice-president of Binney & Smith, will act as vice-president of the new concern, while Edwin B. Brooks, export manager of the parent firm, will be manager. The subsidiary's offices will be located with those of the parent company at 41 East 42nd St., New York 17, N. Y.

No. California Elects Officers

Don Good, of the American Rubber Manufacturing Co., Oakland, Calif., was elected president of the Northern California Rubber Group for the 1949 season at the Annual Christmas Party of the group held on December 13, 1948, at the Club Alsam in Lafayette, Calif. Robert J. Henderson, also of American Rubber, was elected vice-president. Robert R. James, of the Rubber Laboratory, Mare Island Naval Shipyard, was elected secretary, and Neil McIntyre of the Oliver Tire & Rubber Co., Oakland, Calif., treasurer. George B. Farwell and George I. Petelin, of the Goodyear Rubber Co., and John A. Liljegren, of the Pioneer Rubber Mills, were elected directors of the group. Ross E. Morris, of the Mare Island Rubber Laboratory, the outgoing president, will also act as a director for 1949. Approximately 90 members and guests attended the Christmas party. Gifts were awarded to the ladies and to the outgoing officers.

Mission Rubber Expansion

The Mission Rubber Co., South Gate, Calif., has announced the expansion of its factory facilities to manufacture latex foam in sheets and molded articles. The company has been manufacturing blown rubber sponge sheets and molded items under the trade name "Elasticell." The latex foam will be sold under the "Elastex" trade name. The expansion program, estimated to cost approximately $50,000, includes an increase of 3,600 square feet to plant facilities.

Connecticut Meets February 11

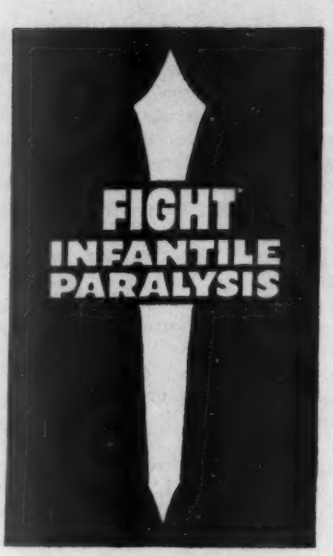
The next meeting of the Connecticut Rubber Group will be a dinner meeting at the Hotel Barnum in Bridgeport, Conn., on Friday, February 11. The principal speaker will be N. L. Catton, of the DuPont Rubber Chemicals Division, who will deliver an address on "Processing Characteristics of Neoprene." Michael MacDougall, the famous "card detective," will provide the entertainment. Dinner will be served at 7:00 P.M.

Southern Ohio Holds Party

The Southern Ohio Rubber Group held its Annual Christmas Party on December 10 at the Miami Valley Golf Club in Dayton, Ohio. The distribution of gifts was by "Santa" himself, and each lady present received a jeweled compact, while many of the club members received door prizes. Approximately 180 members and guests participated in the dinner party, the entertainment and dance which followed.

Quebec Group Hears Peters

The December 16 meeting of the Quebec Rubber and Plastics Group held at Legion Hall, Montreal, Quebec, Canada was addressed by F. H. Peters of the Bank of Montreal. The subject of Mr. Peter's address was "Industrial Development in Canada." At the business session of the meeting it was decided to hold alternate rubber and plastic technical meetings throughout 1949.



MARCH OF DIMES

FIRESTONE REPORTS PROFIT OF $27,674,344 FOR FISCAL YEAR

The Firestone Tire & Rubber Co. in the fiscal year ended October 31, 1948, increased its net earnings to $27,674,344, or $13.83 a share, from the $26,977,877, or $13.45 a common share, reported for the fiscal year ended October 31, 1947. Consolidated sales for the 1948 year totaled $633,858,424, against $638,447,166 the previous year. Improvement in the profit margin in the past year was attributed to a decline in cost of goods sold to $477,773,818 from $494,168,804 in the 1947 period.

During the past year, Firestone operated its tire plants at capacity, which enabled the company to supply demands, except in a few tire sizes, and to increase tire and tube inventories, according to the annual statement issued by the company. Total inventories of the company as of October 31, 1948, amounted to $139,534,370, compared with $123,025,265 the year before.

At the end of the 1948 fiscal year the company's working capital was $160,716,782 compared with $145,585,286 on October 31, 1947. Expenditures by Firestone for improvements and additions to plants and equipment during the year totaled $21,623,284.

Armstrong Rubber Company

Year Ended Sept. 30: Net income of $1,697,930, equal to $4.35 a share on the combined Class A and B common stock, which compares with $2,033,647, or $5.24 a share, in the previous fiscal year. Net sales amounted to $33,297,908 and $34,266,409, respectively.

A. G. Spalding & Bros., Inc.

Year Ended Oct. 31: Net income of $1,536,403, equal to $2.95 a common share, which compares with $2,178,902, or $4.18 a share, in the previous fiscal year. Net sales amounted to $23,359,034 and $24,242,499, respectively.

Organize Carlisle Corporation

According to Furber Marshall, president of the Pharis Tire & Rubber Co., Newark, Ohio, now in process of liquidation, the Carlisle Corporation has been organized to take over the activities of two of the company's subsidiaries, namely, the Carlisle Tire & Rubber Co., at Carlisle, Penna., and the Molded Materials Division, at Ridgeway, Penna. The plants and machinery of the Pharis concern at Newark are scheduled to be sold at public auction later this month. The bicycle tire department at Newark, however, is being transferred to the Carlisle plant. Mr. Marshall also announced that a new sales agency, known as Pharis, Inc., has been organized by Burt Pharis, son of the founder of the company, which will continue to sell Pharis tires and tubes, the tires being made by the Mansfield Tire & Rubber Co. and the tubes by Carlisle Tire.

Weidlein To Address ACS Meeting

Dr. Edward R. Weidlein, Director of the Mellon Institute for Industrial Research, Pittsburgh, Penna., will be the speaker at the informal dinner concluding the Meeting-in-Miniature to be held by the Philadelphia Section of the American Chemical Society on January 20, at the Broadwood Hotel in Philadelphia. Dr. Weidlein's subject will be "Trends in Industrial Research." He has been director of the Mellon Institute since 1921, and is a past president of ACS and of the American Institute of Chemical Engineers. Dr. Weidlein is the co-author of two books, "Glances at Industrial Research," and "Science in Action." During World War II, he served as consultant to different Government offices.

Johnson Plans Plastic Plant

The Johnson Rubber Co., Middlefield, Ohio, has purchased a three acre site near Chagrin Falls, Ohio, and will shortly construct a new plant for the manufacture of molded and extruded plastic products. The new plant will be operated by the Johnson Plastic Corporation which will be a wholly-owned subsidiary of the Johnson Rubber Co., and will be known as the plastic division of the parent company. When completed and in full operation, the plastic plant will employ approximately 100. William Miller, Jr., has been named manager of the new operation.

Liquidate Malayan Owners Co.

At an extraordinary general meeting of the Malayan Rubber Estate Owners Company recently the voluntary liquidation of the company was approved, its purpose having been achieved. Chairman Sir John Hay told the Fourth Annual Meeting, held in London, that the company had played a remarkable part in the recovery which the Malayan rubber industry had made from its war misfortunes. During its short existence the company had arranged transport for over 1,000 planters and administrators, and had incurred a deficit of only approximately $170,000.

N. Y. Group Elects Officers

Election of officers featured the Christmas Party of the New York Rubber Group, held at the Hotel Henry Hudson in New York City on December 10. Pete Murawski, of the DuPont Rubber Chemicals Division, was elected chairman, and D. E. Jones, of the American Hard Rubber Co., vice-chairman. Emil W. Schwartz, of Southern Clays, Inc., was elected sergeant-at-arms, and B. B. Wilson, of *India Rubber World*, secretary-treasurer. Elected to the Executive Committee for three year terms were the following: Edward N. Cunningham (Enjay), T. A. Bulifant (Barrett), George N. Vacca (Bell Telephone Labs.), and John J. DeMunnik (American Tile & Rubber). Both Joseph E. Waters (General Cable), the retiring chairman, and Peter P. Pinto (RUBBER AGE), are ex-officio members of the Executive Committee. The Nominating Committee consisted of Simon Collier (Johns-Manville), George J. Wyrough (Carroll), and Harry E. Outcault (St. Joseph Lead). The Christmas Party was marked by an excellent dinner, elaborate entertainment, and the distribution of some 110 prizes to holders of lucky number tickets.

Plan Symposium on Calendering

A Symposium on the Calendering of Rubber will feature the next meeting of the Chicago Rubber Group, to be held on February 4 at the Morrison Hotel in Chicago, Ill. The Symposium will be held from 4:00 to 6:00 P.M. and will be followed by dinner and the regular meeting. It will feature two papers, one on "New Equipment for Precision Calendering," by G. V. Kullgren, of the Adamson United Co., and the other on "Instrumentation in the Rubber Industry as Applied to Fine Calendering," by N. R. Stilwell, of the Foxboro Co. Both speakers are well qualified for their subjects. Mr. Kullgren was with the General Electric Co. until 1943 when he joined the Farrel-Birmingham Co. in the Akron office, and assumed his present job as manager of the contract engineering division of Adamson United in 1945. Mr. Stilwell began his association with the instrument industry in 1927 when he joined the Akron office of the Atlantic Precision Instrument Co. and has been with the Foxboro organization since it took over the former organization in 1936. He is now associated with Foxboro's Detroit office.

Chicago Holds Christmas Party

Over 700 members and guests attended the annual Christmas Party of the Chicago Rubber Group, held on December 17 in the Terrace Casino of the Morrison Hotel in Chicago, Ill. The activities were preceded by a general cocktail hour, and the dinner was followed by a program of variety vaudeville acts and dancing. All lady guests received attractive pins as souvenirs, as well as door prizes to holders of lucky number tickets. The Christmas Party was arranged by Ralph Anschuetz (Witco) as chairman, assisted by Dr. H. A. Winkelmann (Dryden Rubber), Vincent LaBrecque (Victor Manufacturing), C. E. Wonder (Van Cleef), and Joseph Zak (Cary).

Waterproof Motor Covers

The Davol Rubber Co., Providence, R. I., in order to prevent damage to mill motors by water during a fire, has a salvage truck equipped with waterproof covers, sawdust, brooms, shovels and extra sprinkler heads. In the event of a fire, the truck is taken to the scene by salvage brigades who cover the machinery and stock, and sweep out the floors. Waterproof covers also find use for such emergencies as mill-piping leaks, or when rain enters through broken windows or torn roofing. In this way serious damage to machinery resulting from sprinklers or floor leakage is made negligible.

WASHINGTON HEARS HAUSER TALK ON ELASTIC COLLOID STRUCTURE

The sixth regular meeting of the Washington Rubber Group was held on December 28, 1948, in the Assembly Hall of the Cosmos Club, in Washington, D. C. Dr. Ernst A. Hauser of the Massachusetts Insitute of Technology was the principal speaker of the evening. The subject of Dr. Hauser's address was "Structure and Composition of Elastic Colloids."

The results of extensive research on the structure and composition of colloidal matter possessing elasticity, which included the application of electron microscopy and ultramicroscopy with incident light, were discussed by Dr. Hauser. On the basis of these findings, it was not only possible to offer further support for the so-called two-phase theory of the structure of rubber, but also to give the first visual evidence that all colloids exhibiting elasticity are of a two-phase composition.

The solvating medium can either be of the same chemical composition as the dispersed phase, but of lower molecular weight, as in rubber, polystyrene and some of the elastic silicones, or of entirely different composition, as in gelatine or silica gels, said the speaker. Visual evidence and an explanation were offered on why guttapercha and polystyrene exhibit plasticity only at elevated temperatures.

In conclusion, the increasing importance colloid chemistry is playing in research pertaining to matter exhibiting elasticity was emphasized.

Nelson Heads Buffalo Group

Wayne Nelson of the American Container Corp., Depew, N. Y., was elected chairman of the Buffalo Rubber Group for the 1949 season at the annual Christmas Party held on December 14, 1948, at the Hotel Westbrook, Buffalo, N. Y. John Augenstein, U. S. Rubber Reclaiming Co., Buffalo, was elected vice-chairman. Paul Sick was elected secretary-treasurer. Approximately 130 members and guests attended the meeting. Dr. George Goldfinger of the University of Buffalo will address the next meeting of the group to be held on January 18 at the Westbrook Hotel in Buffalo.

Plans for Fabric Symposium

The Akron Rubber Group has completed plans for the Symposium on Industrial Fabrics which will feature its Winter Meeting to be held at the Mayflower Hotel in Akron on Friday, February 18. Two papers will be given, one on "Cotton as a Raw Material for Industrial Fabrics," prepared by Warren F. Busse and H. R. R. Wakeham, of the Institute of Textile Technology, and the other on "Synthetic Fibers in Industrial Uses," by H. C. Froehling, of the DuPont Rayon Technical Division. A panel of experts drawn from all parts of the country will be prepared to answer all audience questions. This panel includes E. M. Penny (Owens-Corning Fiberglas), A. H. Burkholder (Industrial Rayon), K. D. Smith (National-Standard), H. S. Grew, Jr. (Wellington-Sears), and H. B. Shearer and A. B. Baker (American Viscose). Following the symposium, which will begin at 4:00 P.M., a social hour, dinner and evening program will be held. The after dinner speaker will be L. F. Livingston, of the DuPont organization, who will speak on "Preview of Progress."

Capen Heads Boston Group

Election of 1949 officers and a program of entertainment featured the Winter Meeting and Christmas Party of the Boston Rubber Group, held on December 17 at the Somerset Hotel in Boston, Mass. Bernard H. Capen, of the Tyer Rubber Co., was elected chairman, and Harry W. Sutton, of the Boston Woven Hose & Rubber Co., vice-chairman. Thomas C. Edwards, of the Acushnet Process Co., was elected secretary-treasurer. Both John Andrews (Cabot) and Edward D. Covell (Stedfast Rubber) were elected to the Executive Committee. The Nominating Committee consisted of Charles E. Reynolds, James R. Geenty and Harry A. Atwater. After the election a floor show was enjoyed and prizes were awarded to holders of lucky number tickets. It was announced that the group would hold a Ski Outing at Windsor, Vermont, on February 11 and 12, with Walter Edsall (Goodyear, Windsor) in charge of activities. Approximately 420 members and guests attended the meeting.

Detroit Group Elects Officers

An election of officers featured the Annual Christmas Season Meeting and Jamboree of the Detroit Rubber and Plastics Group held on December 10, 1948, at the Detroit-Leland Hotel, Detroit, Mich. Officers elected included: *Chairman*, W. B. Davies (Kaiser-Frazer); *Vice-Chairman*, G. M. Wolf (Sharples Chemicals); *Secretary*, J. C. Dudley (Chrysler); *Treasurer*, E. J. Kvet (Baldwin Rubber); *Counselor*, J. P. Wilson (Ford). The Executive Committee consists of the following members: *Membership*, T. W. Halloran (Chemical Products); *Program*, G. T. Lindner (Minnesota Mining & Mfg.); *Publicity*, G. R. Cutherson (U. S. Rubber); *Counselor*, R. J. Shroyer (R. T. Vanderbilt), G. P. Hollingsworth (Minnesota Mining & Mfg.), and P. Smith (General Tire).

NAMES IN THE NEWS

E. L. CARLOTTA, associated with the Parker Appliance Co., Cleveland, Ohio, since 1941, and superintendent of rubber production since 1945, has been appointed research and development engineer for rubber products of the company.

WALTER K. BENCHLEY, special assistant to the chief engineer of Hewitt-Robins, Inc., Buffalo, N. Y., has been reappointed purchasing agent of the Rubber Division, a post he previously held for 10 years. WILLIAM A. FLEISCHMAN, associated with the company since 1922, has been appointed to the newly-created position of purchasing agent for the company's Restfoam Division.

W. J. FRISBY, formerly executive vice-president of the Polson Rubber Co., Garrettsville, Ohio, has been elected president of the company.

EDWARD P. COXHEAD, formerly vice-president of the Pioneer Rubber Mills, San Francisco, Calif., has joined the staff of the Goodyear Rubber Co., in San Francisco.

C. S. HANCOCK, associated with the Pure Calcium Products Division of the Diamond Alkali Co. since 1936, has been promoted to manager of calcium carbonate sales.

P. W. LITCHFIELD, chairman of the board of the Goodyear Tire & Rubber Co., was recently awarded the president's certificate of merit by the United States Air Force.

LAVERNE E. CHEYNEY, until recently with the Battelle Memorial Institute as a research engineer, and previously associated with the Goodyear Tire & Rubber Co., has joined the Waterproof-Ohio Paper Co., Middletown, Ohio, as research director.

ROLLA H. TAYLOR, formerly associate rubber technologist at the National Bureau of Standards in Washington, D. C., is now rubber technologist for the Department of Agriculture at Salinas, Calif.

ALFRED BELLIS, for many years chief electrical engineer of John A. Roebling's Sons Co., Trenton, N. J., has retired. For the past twenty-five years he has been active in A.S.T.M. committee work.

MAURICE DAVIER, associated with the Johns-Manville Corp. for many years in various executive capacities, has been named general manager of the company's Van Cleef Division. NOAH VAN CLEEF continues as president of Van Cleef Brothers, Inc., which is wholly-owned by Johns-Manville.

BERNARD H. MCGUINESS, for three years works manager of the Passaic, N. J., plant of Hewitt-Robins, Inc., has been appointed vice-president of the company's Robins Conveyors Division.

C. F. HAWKER, vice-president in charge of manufacturing of the Armstrong Cork Co., and associated with that company since 1930, has been elected a director of the company.

WHIPPLE JACOBS, formerly president of the Belden Manufacturing Co., has been named president of the Phelps Dodge Copper Products Corp., succeeding WYLIE BROWN, who is now chairman of the board.

DR. FRANK B. JEWETT, formerly chairman of the board of the Bell Telephone Laboratories and formerly president of the National Academy of Sciences, has been appointed a member of the board of trustees of Battelle Memorial Institute.

H. B. SOULEN, formerly vice-president in charge of manufacturing for the Mansfield Tire & Rubber Co., has been elected president of that company, succeeding GEORGE W. STEPHENS, who held that post for the past 25 years and who has been elected chairman of the board.

GEORGE A. DANIELS, controller of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, for the past two years, has been appointed secretary and treasurer of that company, succeeding W. C. BATCHELOR, who resigned after 33 years of service.

HERBERT E. SMITH, chairman of the board of the U. S. Rubber Co., has accepted the leadership of the rubber industry's group for the 1949 Red Cross Fund. He is also acting as chairman of the rubber committee in the current anniversary appeal being launched by the New York Public Library.

CHARLES S. CRAIGMILE, formerly executive vice-president of the Belden Manufacturing Co., Chicago, has been elected president of that company, succeeding WHIPPLE JACOBS, who has become president of the Phelps Dodge Copper Products Corp. A. L. WANNER, formerly treasurer, has been elected a vice-president.

THOMAS F. O'NEIL, vice-president and director of the Yankee Network, Inc., and DAN A. KIMBALL, vice-president of the company's west coast operations, have been elected members of the board of directors of the General Tire & Rubber Co.

FRED A. SCHWARZ, associated with the U. S. Rubber Co. since 1911, has been appointed manager of credits and collections, succeeding FRED A. CYR, who has retired after nearly fifty years of service.

R. J. MCKEEFERY, associated with the Sindar Corp., and its associate company, Givaudan-Delawanna, Inc., since 1946, and previously connected with *Oil, Paint & Drug Reporter*, has been appointed to the sales staff of the Sindar company.

DR. WILLIAM L. DAVIDSON, associated with the B. F. Goodrich Co. since 1940, and a recognized authority on atomic energy, has been named director of the company's physical research department.

THOMAS B. WEICHEL, formerly associated with the United States Bureau of Mines, has joined the Sales Department of the Hazard Insulated Wire Works Division of the Okonite Co. as mining electrical engineer.

HOWARD S. BERGEN, associated with the Monsanto Chemical Co. since 1946, has been appointed assistant coordinator of the plasticizers, resins and solvents group of the Organic Division Development Department.

GRANVILLE T. POWNALL, associated with the U. S. Rubber Co. since 1942, has been elected an assistant secretary of the company with additional duties as assistant to HERBERT E. SMITH, newly-elected chairman of the board.

EDWARD W. KIEL, associated with the Gadsden, Alabama, plant of the Goodyear Tire & Rubber Co. for the past few years, has been transferred to the company's Jackson, Mich., plant, where he will be chief chemist.

JOHN A. SARGENT, vice-president of finance of the Diamond Alkali Co., Cleveland, Ohio, since May, 1947, and associated with the company since September, 1946, has been elected executive vice-president of the company.

GORDON GROTH, associated with the Pennsylvania Rubber Co. for five years as vice-president in charge of sales, has been appointed vice-president and general manager of the company.

EMILE COENE, JR., formerly associated with John W. Harris Associates, has been appointed assistant to the vice-president in charge of sales of A. G. Spalding & Bros., with headquarters in New York City.

DR. GEORGE E. ZIEGLER, associated with the Midwest Research Institute, Kansas City, Mo., since 1945, and for the past six months acting administrator of the Institute, has been appointed director of the organization. DR. CLAYTON O. DOHRENWEND, associated with the Institute as a research consultant since 1946, has been appointed assistant director.

E. V. CRANE, formerly vice-president of Sam Tour & Co., Inc., has been appointed chief engineer of the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio.

SAMUEL W. STRING, JR., formerly comptroller of the Firestone Rubber & Latex Products Co., Fall River, Mass., a subsidiary of the Firestone Industrial Products Co., has been appointed comptroller of the parent company at Akron.

DR. ERNEST H. VOLWILER, executive vice-president of Abbott Laboratories, has been named president-elect of the American Chemical Society to take office in 1950.

CANADIAN NEWS

The volume of the Goodyear Tire & Rubber Co. of Canada, Ltd., in line with conditions prevailing throughout the rubber industry in Canada, will be down from the record results of 1947, which was the best year in the company's history. Sales for 1947 were abnormally high as the closing down of the New Toronto and Bowmanville plants for approximately four months in 1946 due to strike conditions had the effect of throwing into 1947 sales and profits which would otherwise have been made in 1946.

The mill at St. Hyacinthe has operated at capacity in producing both cotton and rayon cord fabrics. Capacity of the New Toronto and Bowmanville plants was substantially increased during the war and this high rate of production is continuing. The new Airfoam and Pliofilm factories at New Toronto are producing large quantities and the new unit at St. Malo, Quebec, for the manufacture of rubber molded goods is in partial operation, with delays in delivery of machinery, etc., holding up the work.

Dividends of $3.50 in 1948 against $10 in 1947, reflects the fact that capital expenditures have been fairly heavy, and with more money required to carry on business in these days of high costs, the directors felt this policy was in the best interest of stockholders.

Rubber consumption in October rose to 14,223,000 pounds from 13,642,000 in September, the Bureau of Statistics reports. This included 7,889,000 pounds of natural rubber, 3,702,000 pounds of synthetic and 2,632,000 pounds of reclaim, against 7,534,000 natural, 3,607,000 synthetic and 2,500,000 reclaim the previous month.

Consumption of rubber in the production of tires and tubes, including tire repair material, increased by 380,600 pounds, and in rubber footwear by 250,000 pounds. In the production of wire and cable, consumption decreased by 24,100 pounds and in other products by 25,500 pounds.

Domestic production of synthetic rubber was lower in October, amounting to 6,628,000 pounds, compared with 9,287,000 pounds in September, while the output of reclaim rose to 786,000 pounds from 771,000.

Month-end stocks of natural rubber rose to 17,270,000 pounds from the September total of 14,860,000. Stocks of synthetic rubber fell from 10,907,000 pounds to 8,517,000, and reclaim from 4,077,000 pounds to 3,922,000.

One-third of all Canada's jobs and income is derived from export trade, according to a statement by C. S. Band, chairman of Gutta Percha and Rubber, Ltd., in a radio address recently.

"If we stopped doing business with other countries and tried to live on our own resources," he said, "Canadians would soon find pay checks about 35 cents short on every dollar, there would be one-third fewer jobs, and this position would become progressively worse.

"Right now, we are entering a period of keen competition in world trade, and Canadian exporters must do everything they can to improve their service to foreign buyers. We are all in the same boat, whether we work with our hands or our brains. We have got to produce quality goods at the lowest possible price. If our products are not competitive in price and quality, they cannot be sold abroad."

As previously announced, the next annual conference of the Chemical Institute of Canada will be held in Halifax from May 30 to June 1, inclusive. Owing to the difficulties in obtaining hotel accommodations and facilities for the meetings, the Conference Committee has requested that the program of the technical sessions be completed at an early date. Accordingly, the committee is urging all those who plan on presenting a paper at the Halifax conference to make their wishes known as early as possible.

New Canadian Journal

Carrying out the declared desire of the membership expressed at the last annual meeting of the Chemical Institute of Canada, the board of directors has announced that beginning next April the Institute will publish its own official journal under the name of "Chemistry in Canada." The new journal will be edited by the Institute's own staff and will report news of chemical developments in Canada and abroad, as well as news of Institute activities and the proceedings of local sections and student chapters. The annual subscription price for "Chemistry in Canada" will be $2.00 and will be included in Institute dues. Non-members may enter subscriptions at a cost of $4.00 per year. Headquarters of the Chemical Institute of Canada are at 18 Rideau St., Ottawa, Canada.

URW to Ask Bigger Pensions

A campaign to increase the number of pension systems in the rubber industry and broaden those already in existence was recently announced by the United Rubber Workers (CIO). H. R. Lloyd, international vice-president and chairman of a general pension committee created by the general executive board, said a survey of existing plans will be made and a recommendation submitted to the board at its February meeting. All the "big four" companies have pension plans in effect as well as some of the smaller firms in the industry. Mr. Lloyd stated that present pension plans are entirely inadequate.

LOS ANGELES NEWS

The December 3rd meeting of the Los Angeles Rubber Group was the big annual Christmas Party. Held this year at the Los Angeles Breakfast Club on Los Feliz Boulevard, it attracted over 300 members and their wives and guests. The meeting featured a social hour, dinner, dancing, distribution of door prizes, and the introduction of the 1949 officers.

The new officers, selected by letter ballot, include the following: *Chairman,* Charles Churchill (Sterling Rubber); *Associate Chairman,* E. C. McLaughlin (H.M. Royal); *Vice-Chairman,* R. D. Abbott; *Secretary,* A. J. Hawkins, Jr. (DuPont); *Treasurer,* L. E. Budnick (Ohio Rubber).

Three new directors were also elected, as follows: Carl S. Hoglund (Goodyear), D. C. Maddy (Harwick Standard Chemical), and Robert Short (Kirkhill Rubber). Phil Drew (Goodyear), the retiring chairman, automatically becomes a member of the board of directors.

The Christmas Party, one of the most successful held to date, was arranged by a special committee consisting of E. C. McLaughlin (H. M. Royal) as chairman, assisted by George Steinbach (Atlas Sponge Rubber), Tway Andrews (H. M. Royal), and J. R. Morath (Naugatuck Chemical).

The largest pressure vessel of its type to be built in the west was recently installed in the local plant of the Firestone Tire & Rubber Co. Measuring 43 feet in depth and 12½ feet in diameter, the unit is one of the world's largest curing chambers and will be used in connection with rubber fuel cells now being made by the company. Of A.S.M.E. approved electric welded construction, it was built to withstand 100 lb. working pressure or full vacuum. The unit was designed and built by the United Welding & Manufacturing Co., a division of Harris Enterprises, Inc., of Los Angeles.

The Pacific Latex Co. has moved from 338 South San Pedro St. to 434 Crocker St.

Skilbilt, Inc., 2255 Barry Avenue, West Los Angeles, have expanded operations to include the manufacture of small molded precision products.

Franklin J. French, associated with the Gates Rubber Co. for approximately twenty years, has joined the staff of the Kirkhill Rubber Co. Robert D. Gray, connected with Gates for the past three years, has joined the technical staff of Pioneer Rubber Mills, Inc.

OBITUARIES

Howard W. Matheson

Dr. Howard W. Matheson, formerly vice-president of Shawinigan Chemicals, Ltd., of Montreal, died at his home in Hudson Heights, Quebec, Canada, on October 2. Long prominent in the field of chemical research, he retired a few years ago due to ill health. At the time of his retirement he was a vice-president of the Shawinigan Resins Corp., of Springfield, Mass., and of Canadian Resins and Chemicals, Ltd., of Montreal, and a director of the Shawinigan Products Corp., of New York City, as well as vice-president of the parent company. Dr. Matheson was born in Pictou, Nova Scotia, on December 5, 1886. He was educated at Truro Academy and was graduated from Dalhousie University in 1910. After serving for a time as an instructor at McGill University he joined the DuPont organization at the experimental station in Wilmington, Del., later returning to Canada where he was affiliated with various concerns before joining the Shawinigan interests. He was also a member of numerous chemical associations.

Willis G. McCullough

Willis Gerald McCullough, president and director of the Collins & Aikman Corp., textile manufacturers of New York City, died at his home in Cummings Point, near Stamford, Conn., on December 17. He was 59 years old. Born in New York, Mr. McCullough came to Collins & Aikman in 1916 after a period with Blumenthal & Co. Twenty years later he rose to the presidency of the organization. During his association with the company, he pioneered in the development of fabrics for automobile upholstery. Mr. McCullough was a member of the New York, Stamford, and Larchmont Yacht clubs, the Metropolitan Opera Club and the Cruising Club of America. His wife, two sons and four daughters survive.

Lurn E. Moore

Lurn E. Moore, former secretary and general manager of the Warren Rubber Co., died at his home in Champion Heights, Ohio, on December 16 of a heart ailment. He was 74 years old. Born in Windsor, Ohio, October 17, 1874, Mr. Moore was for many years prior to 1939 an official of Warren Rubber. He was a charter member of the Warren Commercial Travelers, a member of the Real Estate Board and the board of the first Methodist Church, Warren, Ohio. His wife and two sons survive.

Joseph Holstein

Joseph Holstein, president of Holstein Rubber Products Co., Hartford, Conn., died on December 21 at a hospital in Miami Beach, Fla. He was 71 years old.

Eldon M. Eckhardt

Eldon M. Eckhardt, executive vice-president in charge of carbon black, oil and gas operations for the J. M. Huber Corp., died on November 28 at his home in Amarillo, Texas. He was 52 years old. Mr. Eckhardt was born in 1896 near Peoria, Ill. After attending Illinois State Normal College, he became a teacher for the Government in the Philippines. He was released from his teaching contract during World War I so that he could join the Air Corps. In 1926 he joined Huber as superintendent of its Breckenridge, Texas, carbon black plant. Later, he was transferred to Swartz, Louisiana, as superintendent of Huber's plant there. In 1936 he went to Borger, Texas, as assistant to the general manager and in 1938 he became vice-president in charge of the Borger operation. In 1946, Mr. Eckhardt was named executive vice-president of the company.

James R. Hemphill

James R. Hemphill, president of the Colonial Insulator Co., Akron, Ohio, died on December 22 in Peoples Hospital, Akron, at 88 years of age. Mr. Hemphill was born in Akron on June 8, 1860, and attended Warner & Hammell Business College. In 1894 he organized the Akron Insulator & Marble Co. which was renamed the Colonial Insulator Co. in 1906. Mr. Hemphill was a member of the Rotary Club, the Portage Country Club, and the First Congregational Church. Funeral services were held on December 24 at the Billow Funeral Home in Akron, with interment in Glendale Cemetery. His son survives.

Harry E. Wills

Harry E. Wills, general manager of the Wills Rubber Trimming Machine Co., Canton, Ohio, died at his home in Canton on December 29. He was 66 years old. A native of Jersey City, N. J., Mr. Wills had invented a rubber trimming machine within the last few years of his life. He was well known in local art circles, and was a member of the Canton Art Institute. Services were conducted on December 31, in the Schneeberger funeral home in Canton. His wife survives.

Clifford V. Williams

Clifford V. Williams, general sales manager of the Delco Products Division of the General Motors Corporation, died on December 16 at his home in Dayton, Ohio, at the age of 51. Born in British Columbia, he served in the Canadian Army during the first World War, was wounded at Vimy Ridge and received the Mons Star. His wife and three daughters survive.

Lester A. Brannan

Lester A. Brannan, owner of the L. A. Brannan Co. machine shops, Cleveland, Ohio, died on December 30 in Bedford Hospital, Cleveland, Ohio, at the age of 65. Born in Northfield Township, near Cleveland, Mr. Brannan had formerly been associated with the Stalwart Rubber Co., Bedford, Ohio, as vice-president. For the past 12 years, Mr. Brannan had run the company bearing his name. His wife and son survive.

John J. Voorhees

John J. Voorhees, former president of the Voorhees Rubber Manufacturing Co., Jersey City, N. J., died at his home in Jersey City on December 23 at the age of 72. Mr. Voorhees was graduated from Lafayette College in 1898 and was a member of Phi Kappa Phi Fraternity. He was a former president of Whittier House and served on the executive board of the Jersey City Community Chest and other civic organizations. His wife and daughter survive.

Booklet on Employee Benefits

A specific down-to-earth example of what a moderate size company is doing in the field of labor-management relations is found in a new booklet recently sent to all of its employees by the J. M. Huber Corporation of New York. Entitled simply "Employee Benefits," the booklet first briefly explains the operations of the company and where its products are used, and then, without frills, discusses some 19 benefits available to the employees, including bonus and profit-sharing plans and retirement plans. The booklet, one of the best of its kind prepared, reveals the liberal attitude of the Huber management which is the answer to the smooth-functioning labor-management relations it enjoys.

Coordinate Color Sales

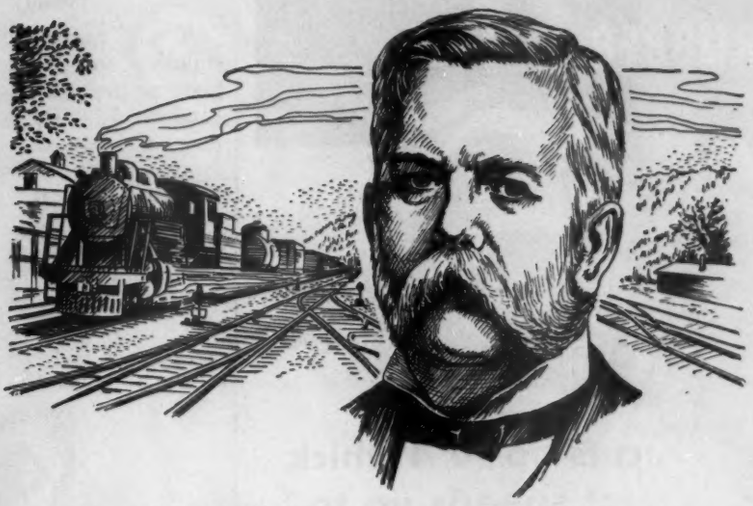
The Rubber Chemicals Division of E. I. du Pont de Nemours & Co., Inc., has limited the sale of colors to the rubber industry to rubber dispersed colors, water dispersible colors and color pastes, effective January 1, 1949. All other pigment colors, including dry rubber colors and a wide variety of organic and inorganic chemical pigments, will be sold by the Du Pont Pigments Department. Company officials stated that the change was being made so that both departments can better serve the rubber industry.

Taylor Changes Company Name

The name of the Taylor Manufacturing Company ,of Milwaukee, Wisconsin, manufacturers of rubber tile floors and bases, as well as of a general line of molded rubber and plastics goods, has been changed to the Wright Manufacturing Co. Offices remain at 3056 West Meinecke Ave. in Milwaukee and the company will continue to operate plants at Milwaukee, Racine, Wisconsin, and Houston, Texas.

TALES WORTH RETELLING

(No. 11 of a series)



When GEORGE WESTINGHOUSE tried to explain his new invention, the air brake, to Commodore Vanderbilt, the Commodore scorned him.

"Do you expect to stop a train with wind?" he asked. "I have no time to spend with fools."

Undaunted, Westinghouse went to work to overcome this belligerent resistance. He invented an improved railroad frog, a switch part, which appealed to the railroad officials so much that they permitted him to have his air brake tested. Today Westinghouse's air brake is universally used to make travel safer.

In business, perseverance is a criterion for success.

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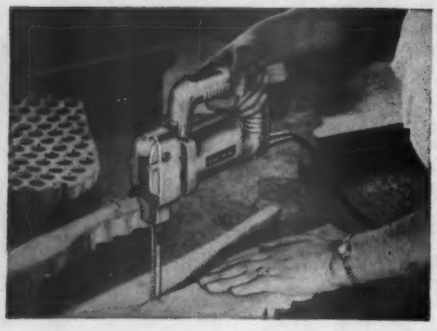
CRUDE RUBBER · SYNTHETIC RUBBER · SCRAP RUBBER · HARD RUBBER DUST · PLASTIC SCRAP

New STANLEY No. 99 SPONGE OR FOAM RUBBER CUTTER

. . . cuts up to 4" thick at speeds up to 30 ft. a minute!



A brand new electric tool designed by Stanley that puts cutting of sponge and foam type rubber on a production basis. Saves time and material.

Follows any line or templet, inside or outside—straight cuts, curves and angles—with hairline precision. No concave edges, no torn or ragged work.

Light weight (only 4 lbs.). The duplex handle permits easy handling on all operations. Girl operators like it.

No. 99 Sponge Rubber Cutter operates on either A.C. or D.C. Blades are made of alloy steel for long life and are easily replaceable.

Save material, save time with the new Stanley Sponge Rubber Cutter No. 99. Ask your supply house, or write for folder. Stanley Electric Tools, 562 Myrtle St., New Britain, Conn.

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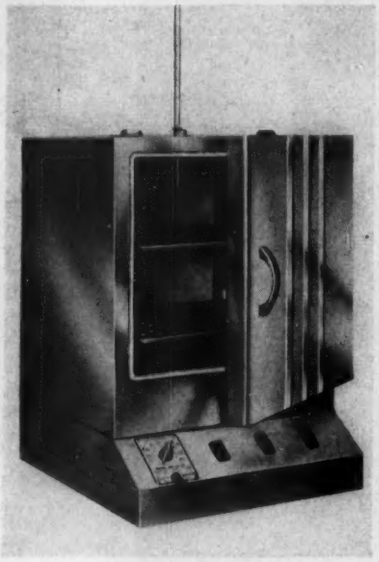
NEW EQUIPMENT

Modern Electric Laboratory Oven

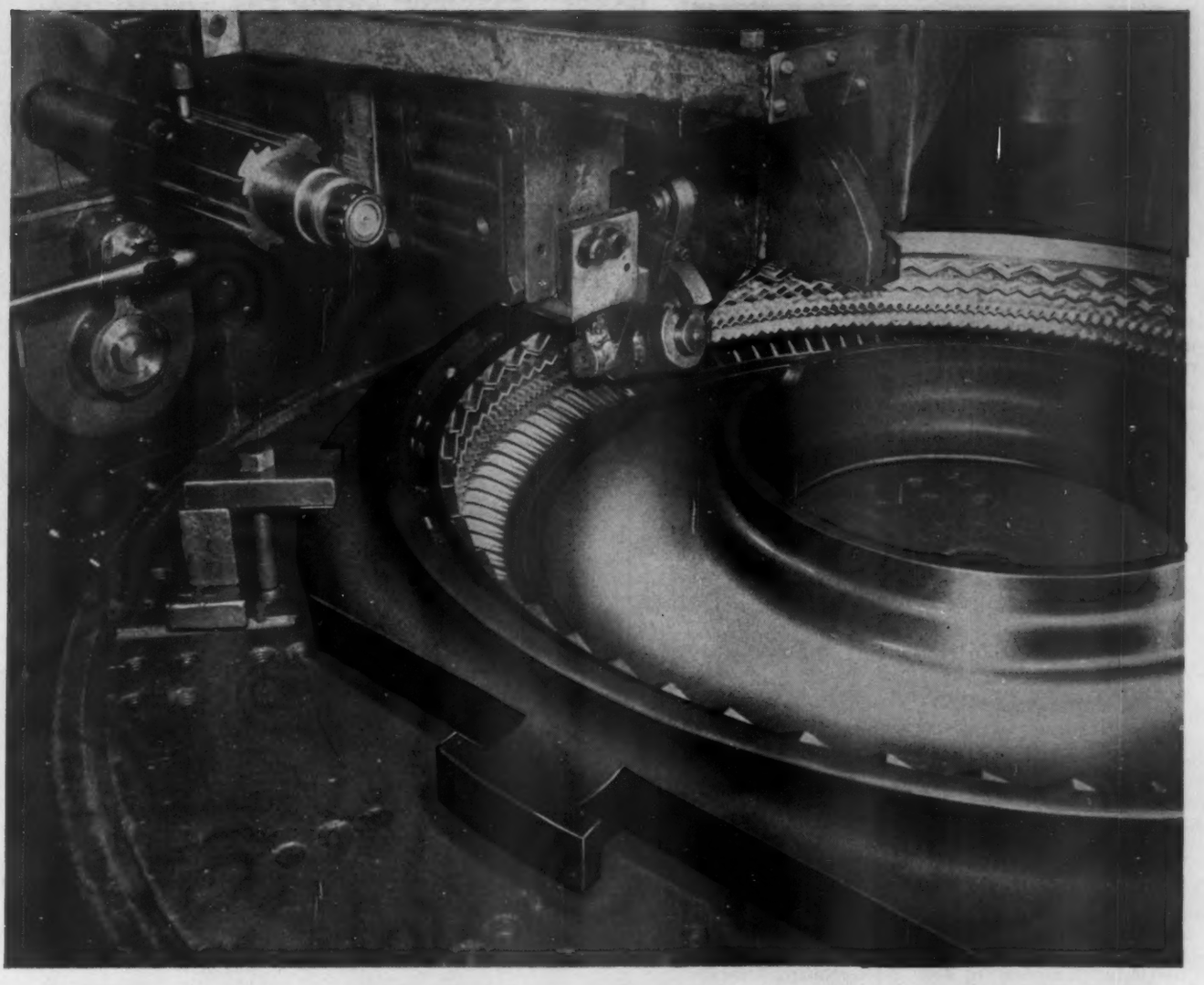
A new heating, baking and drying over of polished stainless steel, suitable for application in the rubber, plastics and allied fields, has been developed by the Modern Electric Laboratory, 6131 South Wentworth Ave., Chicago 21, Ill. Uniform temperature is secured from a heavy nichrome element which covers the entire bottom area of the unit. All six sides are insulated with



Therm-O-Flake bonded block, which reduces wall heat absorption and keeps the exterior cool at all times. The inside dimensions of the oven range from 8x8x8 inches to 14¾ x 17¾ x 19 inches, depending on model. All models have a hydraulic electric thermostat which is extremely accurate and has a response sensitivity of plus-or-minus ½° C. An automatic timer and switch can be furnished to control any set temperature within the range for any length of time from 1 to 60 minutes.

New Temperature and Pressure Recorders

A new line of gas-filled temperature recorders and recording pressure gauges has been introduced by the Penn Industrial Instrument Corp., 3116 North 17th St., Philadelphia 32, Penna. These recorders are available with 1, 2, 3 or 4 pens and provide for easy field installation of the actuating system and pen mechanism if, for example, a 1-pen recorder is to be made into a 2, 3 or 4 pen instrument. Temperature tube systems feature an all stainless steel, Heli-arc welded construction with an improved design of spiral spring. A standard bulb design is arranged so that it can be converted in the field into any of the usual apparatus connections; union flange or hub with bendable extension, union flange or hub with rigid extension, union with separable socket with or without extension neck, or adjustable connection with split flange.



YOU NO LONGER PAY A HIGH PREMIUM FOR KNIFE BLADE MOLDS

As RECENTLY as six years ago the manufacture of knife blade molds was a troublesome and expensive process.

The cutting of innumerable slots to precision depth was slow and difficult. Insertion of knife blades was a patience-trying task for even the most skilled craftsman.

The machine shown above, designed and built by Bridgwater, saws slots in molds for knife blade inserts with a gauge as low as .015". It does it rapidly, with exact precision. The special saws used leave no burrs. Insertion of knife blades proceeds smoothly, quickly.

This development by Bridgwater has resulted in savings to tire manufacturers of up to 50% of the premium formerly paid for knife blade molds.

It is a typical example of our determination to design and build equipment of such a type that we are able to produce economically molds of whatever characteristics the tire industry requires.

THE BRIDGWATER MACHINE COMPANY

Akron, Ohio

FOR BETTER MOLDS FOR BETTER TIRES *SPECIFY* BRIDGWATER

Silicone News

DC SILICONES

Flying Jennys to Jets

In the days of the flying Jenny and the cow pasture airport, comfort was a luxury few airmen had time to consider. Keeping out of the tree tops was a more constant problem than keeping fingers from freezing. But in the sleek new airliners, passengers expect drawing-room comfort. That requires creative engineering because both high and low temperatures are involved and only such relatively new materials as the Dow Corning Silicones can take both extremes.

PHOTO COURTESY ARROWHEAD RUBBER CO.

Silastic-coated glass cloth heating duct seals withstand continuous long time exposure to operating temperatures between 350° and 400° F. in new Consolidated Vultee Convair-Liners.*

In designing the new Convair-Liner, Consolidated's engineers faced heating and ventilating duct conditions that would frizzle any conventional material; maximum temperature 450° F.; operating temperature, 350°-400° F.; internal air temperature, 250°-350° F.; internal pressure, 10 in. of water; misalignment, ⅛ to ¼ inch; vibration from mild to extreme.

That's the problem Consolidated presented to Arrowhead Rubber Company of Vernon, California. Engineers at Arrowhead solved this problem with a Silastic tube reinforced with glass cloth. Arrowhead also uses Silastic, the rubber-like silicone by Dow Corning to produce duct seals that have high performance records at temperatures from −89° to 450° F. and under pressures up to 150 p.s.i. in the newest type jet planes.

That kind of stability is essential to the aircraft industry and is characteristic of all Dow Corning Silicone Products. For the properties of Silastic, phone our nearest branch office or write for pamphlet No. F5-V.

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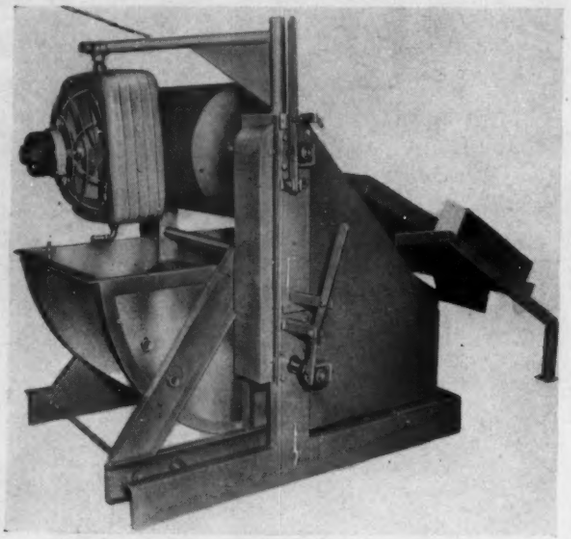
Goodman Two-Way Washer-Dryer

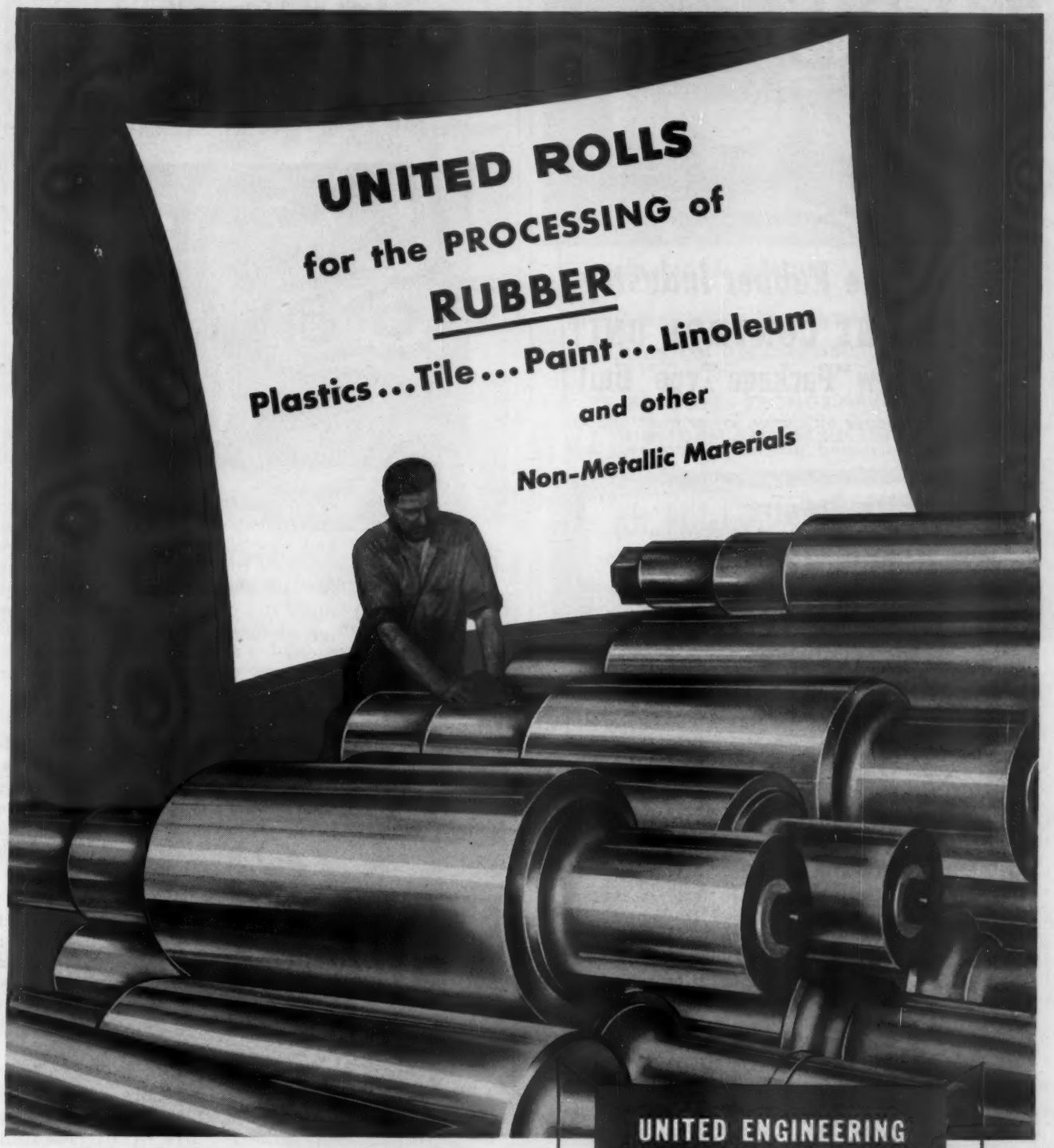
Illustrated herewith is the new two-way washer-dryer currently being manufactured by G. F. Goodman & Son, Richmond and East Columbia Ave., Philadelphia 25, Penna. One drum washes while the other drum



dries, and the upper drum can be loaded or unloaded while the lower drum is washing. Made of stainless steel, the unit is said to assure gentle tumbling action and complete and thorough washing. Simple controls are provided, with push button starting, while generous capacity, with power to spare, is said to be provided.

An improved type of **portable power saw,** which is adapted to the cutting of soft pliable materials, including rubber and leather, has been introduced by the Kett Tool Co., Cincinnati, Ohio. The unit will cut to any desired depth up to ½ inch and is said to leave a smooth edge that requires no filing, sanding or other operation.

Favorites for over 30 years with leading manufacturers



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WITH ONE CONTROL UNIT
or the new "Package Type" Unit

Greater employee efficiency, lower maintenance costs and increased production can be yours with a properly engineered central dust collecting system. Nationally-known plants such as that of the large rubber processing concern shown above, select Parsons consistantly for all their dust problems. Each of these Oval Bag dust arrestors handle 40,000 cubic feet of air per minute continuously, without shut-down.

Parsons' dust collecting systems are the accepted standard for collecting carbon black, talc and all types of rubber dust.

Introducing the new
Dust Control Unit

For collecting dust from individual machines, or from a small group of points where dust is localized in a more concentrated area, the Parsons "GEM" Dust Collector (left) is recommended. This small, compact unit, designed for quick installation, has ample filter cloth to maintain uniform suction. It has proved it's effectiveness in many kinds of rubber plant operations and in scores of other industries.

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Hartig No. 2 Extrusion Machine

A new rubber extruder has been designed and is being manufactured by the Hartig Engine & Machine Co., Hillside, N. J. Called the Hartig No. 2 Extrusion Machine, four different size units are now being produced, ranging from 1¼ to 4½ inches. A 6-inch model is cur-

rently under development. These machines are electrically heated, unless otherwise specified by the customer, and have four-zone electrically-heated cylinders provided with temperature controller to afford a range sufficient to handle all thermoplastics. Hart-tipped screws are drilled for water cooling. The heads of the extruder are of the quick-opening clamp type and a specially-designed cross-head is available for all models for use with vinyl, nylon and other thermo-plastics over wire.

A new **semi-automatic machine for applying standard pressure (masking) tape** to drums, roll goods, canisters, cartons, etc., on a production basis, has been developed by the Lake Laboratories Co., Clifton Heights, Penna. Under actual tests, it is reported to have reduced the manual sealing time by as much as 400 percent.

Safe and convenient transfer of acids and other liquids from carboys, barrels or drums is said to be assured with an **improved foot- or hand-actuated pneumatic pump** developed by the General Scientific Equipment Co., Philadelphia 7, Penna. These pumps are suitable for sulfuric, hydrochloric, hydrofluoric and other acids.

Weston Electrical Instrument Corp., Newark 5, N. J., has introduced a new **contact-making thermometer** which combines the features of an indicating thermometer with an alarm or control device. It consists of the well-known Weston all-metal thermometer with an adjustable contact arm mounted in the glass and bezel.

A new **centrifugal pump,** designated as Model H, designed for applications where moderate pressures and volumes are required from a centrifugal pump running at 1725 r.p.m., has been introduced by Eastern Industries, Inc., New Haven 6, Conn. Units are available with motors ranging from 1/6 h.p. to 1/3 h.p., depending on the operating range desired.

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★ PRODUCES SPONGE HAVING SMALL, UNIFORM CELL STRUCTURE

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NEARLY 50 years of Mixing Mill building experience backed up by a huge steel foundry and modern machine shops — that's why National-Erie can meet your exacting requirements for mixing mill equipment for any range of work. We build a complete standard line that is readily adaptable to special demands. Send your mixing mill problems to N E engineers. Comprehensive catalog covers the complete N E line.

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PRESSURE VESSEL DOORS

These popular doors provide a sealed enclosure for any kind of pressure vessel. They are built in sizes to 96 inch diameter and for pressures to 250 lbs. Write for data.

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SIMPLEX QUICK OPENING DOORS

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by

PUBLIC AUCTION

Pursuant to an Order by the Hon. Gail H. Butt, Referee in Bankruptcy, Columbus, Ohio

we will beginning on

TUESDAY—JAN. 25, 1949 at 10 A.M.

AT PARKERSBURG, W. VA.

and continuing to

MARIETTA, OHIO on

WEDNESDAY—JAN. 26, 1949 at 10 A.M.

Offer for Sale all of the Assets of

CASTO MANUFACTURING CO.

(BANKRUPT)

VALUABLE REAL ESTATE AT PARKERSBURG, W. VA., AND MARIETTA, OHIO, TOGETHER WITH MACHINE SHOP EQUIPMENT, RUBBER AND PLASTIC MACHINERY AND EQUIPMENT, FACTORY SUPPLIES, FINISHED AND UNFINISHED INVENTORY.

Banbury Mixers: 48, 54, 60, 72 and 84" Rubber Mills, Robs and Adamson Hydraulic Presses 42 x 42 to 42 x 84; 3 and 4 Roll Calenders, Industrial Compressors, Extruders, Hydraulic Pumps, Accumulators, Re-winders, Molds, Gear Reducers, Drives, Motor Generator Sets, Laboratory Mills, Curing Ovens, Curing Presses, Portable Scales, Lift Trucks, Gas Powered Factory Trucks, Assorted Pumps, Transformers, Hor. Tubular Boilers, Heating Units, Production Gears, Large Lot Inventory consisting of Red, Black and Brown Vinyl Sheeting in Sheets and Rolls, Strippings, Titanium, Synthetic Rubber Slabs, Trucks (1942 to 1946), Office Furniture and Equipment, Notes and Accounts Receivable, Hundreds of other items too numerous to mention.

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REVIEWS

BOOKS

Principles of High-Polymer Theory and Practice. By A. X. Schmidt and C. A. Marlies. Published by the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 744 pp. $7.50.

This book is a comprehensive treatment of the fundamental principles, concepts and practice applicable to all materials of high molecular weight, including rubbers, plastics, fibers, surface coatings, adhesives, or wood products. In order to foster a basic understanding of the formation, properties, manufacture, development, fabrication, and applications of high polymers, the authors maintain a broad, coordinated approach throughout the book, so that what the reader learns about fibers he will immediately recognize to be translatable also to rubbers, plastics, surface coatings, etc.

The book demonstrates how the fundamentals of chemistry, physical chemistry, rheology, mechanics of materials, and manufacturing techniques may be applied universally to the materials in question, and stresses comparison with metal products. Intended as a text book, the authors have attempted to suit the text to both undergraduate and graduate courses of varying length.

There are 16 chapters in all, as follows: (1) Introductory Definitions and Concepts; (2) Molecular Forces; (3) Some Special Behaviors and Properties of High Polymers; (4) Poylmer Formation and Modification; (5) Structures of High Polymers; (6) Solubility and Molecular-Weight Relations; (7) Rheology; (8) Molding and Manipulation; (9) Mechanical Properties; (10) Electrical, Thermal and Optical Properties; (11) Fibers and Fibrous Products; (12) Rubbers; (13) Rubbers, continued; (14) Surface Coatings; (15) Adhesives; (16) Resin Product Development. There are several appendices and a subject index.

•

The Rubber Industry in Germany During the Period 1939-1945. Prepared by T. R. Dawson. Published by H. M. Stationery Office, London, England. Available from the British Information Service, 30 Rockefeller Plaza, New York 20, N. Y. 6 x 9½ in. 150 pp. 90c.

Prepared for the British Intelligence Objectives Subcommittee and issued as B.I.O.S. Overall Report No. 7, this booklet reviews all of the technological information secured by Allied investigators on German processing, production, analysis and testing of synthetic rubbers, and the manufacture of leading rubber products. Among the highlites of the report is a section on German apparatus for the testing and analysis of rubber, including several novel and promising devices. A comprehensive listing of German trade names for rubber and rubber chemicals, which will prove useful to any researcher examining other German rubber documents, is included. In connection with rubber products, the report deals rather fully with tires, belting, footwear (including heels and soles), hose, packing, surgical goods, and protective linings.

•

The Plastics Buyer: 1948. Published by the Cleworth Publishing Co., Inc., 551 Fifth Ave., New York 17, N. Y. 8 x 11 in. 240 pp. $3.00.

The latest edition of this aid to buyers of merchandise in the selection of properly designed and engineered plastics products has been brought completely up-to-date. Like previous editions, it presents a non-technical discussion of plastics materials, treating with their advantages and limitations, and includes a complete list of consumer products which are made entirely or largely of plastics, with the names and addresses of companies making these products indicated in each instance. A new feature of the current edition is a description of new plastics items introduced in recent months.

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RUBBER STRIP CUTTER

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A PORTABLE machine capable of stripping slab rubber up to 1″ thick at the rate of 20,000 feet in 8 hours. Any width desired.

SPECIAL FEATURES

- Has micro-adjustment for accurate widths.
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- Has repulsion induction motor which carries any overloads.
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- Has base with rollers and is very easy to handle.

Cuts within 1/64 inch to 1/100 inch tolerance depending on grades of rubber. Cuts a slab down to the last shaving. Cuts all grades of rubber including pure gum, sponge, etc. Cuts squarely—no rejects.

Now in use by many leading Rubber Manufacturers & Jobbers

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Manufacturers of a Complete Line of Cloth Cutting Machinery

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FEATURES

Speed of operation • One operator handles up to six units • No mechanical breakdowns • Heat controls in both platens • Splices gaskets up to 3″ in diameter, right angles or T-joints.

SPECIFICATIONS

Bench Space 5″ x 6″ — Bench Overhang 9″
Height 14″ — Hardened Cam and Anvil
Bronze or Hardened Aluminum Platens
Chromalox Heaters — Fenwal Thermostats
Mold Sizes — 1½″ x 2″ x 4″ and 2″ x 3″ x 6″
Pressure Adjustments on Anvil
Current — 110 or 220 Volts

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Continuous Extruding Machines for the Rubber, Plastic and Chemical Industries

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ROYLE No. 2 Extruding Machine. Non-extended cylinder, plain tubing head, direct coupled drive. This extruding machine is designed for conventional applications in the rubber field.

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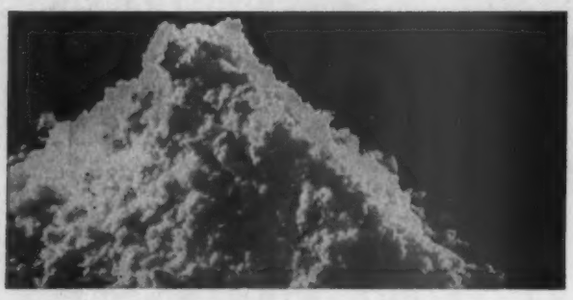

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The New Malaya and You. By H. B. Egmont Hake. Published by Lindsay Drummond, Ltd., London, England. Available from Rubber Development Bureau, 1631 K St., N.W., Washington 6, D.C. 5 x 7½ in. 108 pp.

According to Mr. Hake, who is chairman of the Rubber Development Board in London and has been associated for many years with Harrisons & Crosfields, there are three Malayas—British Malaya, Japanese Malaya, and Malaya of the future. It is with the latter Malaya that this highly entertaining and informative book is concerned and in this sense it represents one of the most up-to-date reviews of the problem of post-war Malaya. Briefly reviewing the past history of the country, Mr. Hake quickly turns to a full discussion of its future potential. Rubber is, of course, vital to that future and occupies a good portion of the text. Specific rubber problems are discussed, including the physical achievement, the labor forces, the planters, the Asiatic producers, the business structure, the problem of stability, the speculative element, and the future. The book should prove of interest to all those concerned with natural rubber.

•

Conversion of Petroleum. (2nd Edition). By A. N. Sachanen. Published by Reinhold Publishing Corp., 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 602 pp. $11.00.

The progress recorded in manufacturing motor fuels in the eight years since the first edition of this book was issued is notable in the current volume. The development of catalytic cracking and alkylation was particularly spectacular. Like the first edition, the current work covers the fundamental principles and practices of converting petroleum products into gasoline and other fuels. Dehydrogenation processes, of extreme importance to the manufacture of synthetic rubber via butadiene, are fully discussed. Completely revised, the current edition contains several entirely new chapters.

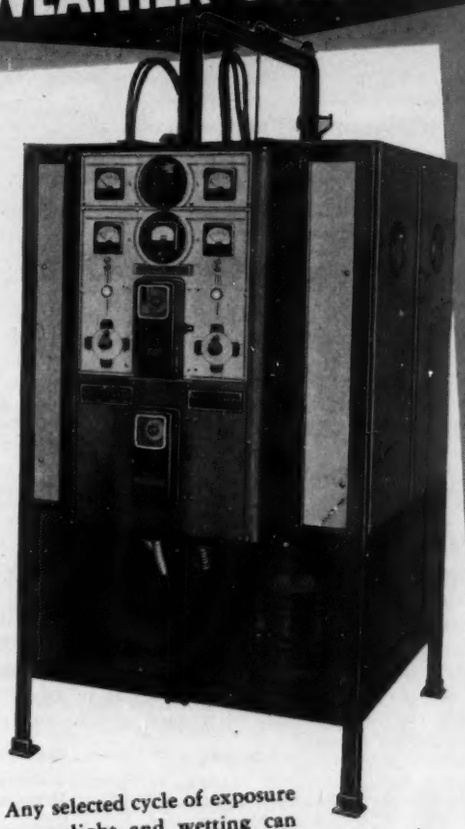
•

A.S.T.M. Standards on Textile Materials. Published by the Society, 1916 Race St., Philadelphia 3, Penna. 6 x 9 in. 560 pp. $4.35.

The latest edition of these standards, which are issued annually, covers 86 specifications, test methods and tolerances developed by Committee D-13 on Textile Materials. A number of appendices are also included covering, among others, the basic properties of textile fibers, yarn number conversion table, proposed test for accelerated aging of textiles, and proposed specification and method of test for fire-retardant properties of treated felt. An index of methods of test is also included.

Weathering qualities of
RUBBER PRODUCTS
determined with reliable accuracy in the

ATLAS *twin arc* WEATHER-OMETER



Any selected cycle of exposure to sunlight and wetting can be set for automatic continuous testing in the Weather-Ometer. Exact tests can be duplicated at any time by settings on the control panel which contains temperature regulator—time meter—light and water cycle switch — automatic cut-off switch — voltage adjusting switch — direct reading thermal regulator — reactance coil (for economical current consumption). The Weather-Ometer is fully automatic in operation; can be left unattended over night; only necessary to renew carbons once in 24 hours. Years of exposure to any conditions of weathering reduced to a few days testing in the laboratory with the Weather-Ometer.

Originators and sole manufacturers of accelerated testing machines for over a quarter of a century. Fade-Ometer, Weather-Ometer, Launder-Ometer — the accepted standard testing machines used all over the world.

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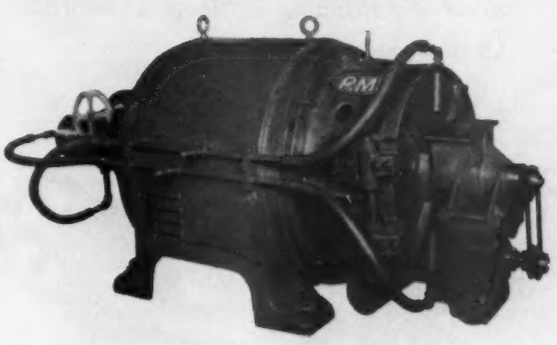
HEAVY DUTY CUTTER

- This machine is specially designed for reducing to small size pieces all kinds of soft and hard rubber scrap.
- Water cooled sides allow continuous operation of the machine, without overheating.
- Provided with safety type drive pulley.
- The capacity of the P.M. CUTTING MACHINE is from 600 to 1000 lbs. per hour on soft rubber and 1000 to 1500 lbs. on hard rubber scrap.
- Power required 10 H.P. 4 V-belt drive.



HEAVY DUTY RUBBER GRINDER

- Available in Direct or Belt Drive.
- 50 H.P. motor.
- Operation entirely automatic.
- Water cooled to permit continuous operation without overheating.
- Fineness of ground rubber easily adjusted by simple turn of wheel.
- Capacity 400 to 800 lbs. per hour.

Developed to meet the need for a more rugged Scrap Rubber Grinder with increased capacity

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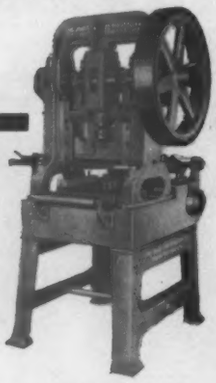
Rubber Cutting Machines with a Lifetime of Uniform Quality

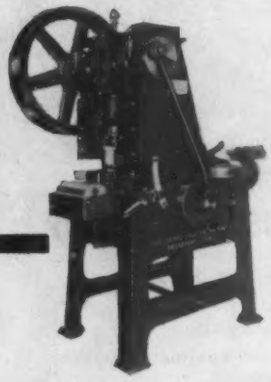
ENGINEERED TO MEET YOUR PARTICULAR REQUIREMENTS



MODEL A2

COULTER RUBBER CUTTING MACHINES have been used successfully for years and years in the cutting of continuous volumetric control and stripping for Heels, Soles, Taps and other molded products.

MODEL A1



- Model A1 for Heels at high speed production, or short runs.
- Model A2 for Multiple Heels, Half and Full Soles with stock grain.

MODEL A3

- Model A3 for Multiple Heels and Taps with or across stock grain.
- Model A2S (Not shown) for cutting crosswise of grain of stock.

PRODUCTION MACHINES SINCE 1896

The James COULTER Machine Co.

BRIDGEPORT • CONNECTICUT • U.S.A.

BOOKLETS, CATALOGS, etc.

Brown Pressure and Vacuum Gauges. (Catalog No. 7000). Brown Instrument Co., Philadelphia 44, Penna. 8 x 10½ in. 31 pp.

Full and complete descriptions of the various instruments produced by the company, such as indicating and recording pressure gauges, recording flow meters and pressure gauges, air-operated controllers, non-indicating pressure controllers, indicating furnace pressure controllers, precision pressure regulators, etc., are given in this catalog. Also featured are pressure actuating elements, high vacuum gauges, the Air-O-Larm system, the Integral Control By-Pass, and Liquid Level Measurement of open and closed vessels. The catalog is illustrated with schematic drawings, photographs and diagrams and also includes pressure range charts and indicating scales.

•

Taylor Guide to Correct Instrument Selection. (Bulletin 98170). Taylor Instrument Companies, Rochester 1, N. Y. 8½ x 11 in. 16 pp.

Representing a revision of a previously published bulletin, this new edition provides a listing of the company's entire industral line. The three basic types of company instruments including indicating, recording and controlling types are discussed and illustrated. Some of the instruments discussed include pressure, humidity, temperature, force or load, etc. Coordinated control systems are also discussed. The bulletin is bound in loose-leaf style.

•

Porter Lubricated Plug Valves. H. K. Porter Co., Inc., Pittsburgh 22, Penna. 8½ x 11 in. 16 pp.

Amply provided with dimensional drawings and tables, this new catalog covers the complete line of Porter lubricated plug valves. A cross section view of the valve is provided which serves to illustrate the valve's advantages. Tables are included which contain in addition to dimensions pertinent data such as size of lubricant stick, size of adaptor for pressure-gun lubrication, size of wrench and locking device, and weight of the valve.

•

Stokes-Standard Semi-Automatic Molding Presses. (Catalog No. 478). F. J. Stokes Machine Co., Tabor Road, Olney P. O., Philadelphia 20, Penna. 8½ x 11 in. 20 pp.

Completely descriptive, this catalog includes specification data and is illustrated with many views of typical Stokes-Standard press installations. Some of the presses receiving particular attention include the new 200-300 ton transfer press, toggle semi-automatic compression presses, and the complete line of Stokes preforming presses.

•

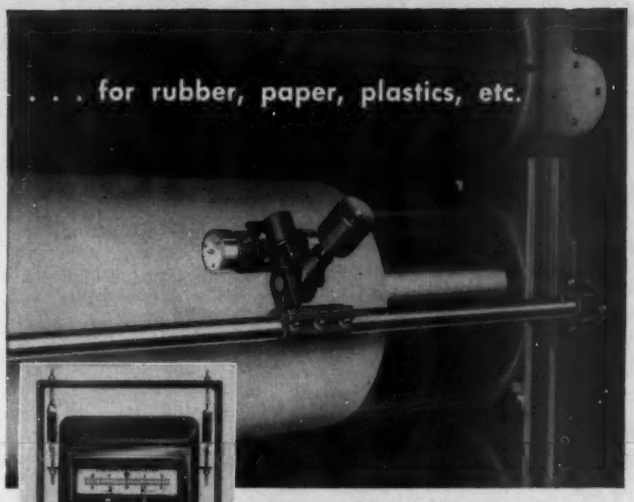
BCF Exchangers. Ross Heater & Mfg. Co., Inc., 1407 West Avenue, Buffalo 13, N. Y. 8½ by 11 in. 8 pp.

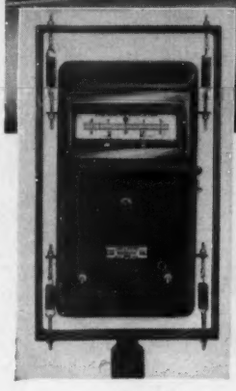
This bulletin gives full treatment to the new Ross mass-produced BCF exchangers as primary equipment and as replacement items. Cut-away views illustrating construction, and line drawings showing sizes, dimensions and weights, accompany brief text descriptions on various applications of these all-nonferrous units.

•

Akron Chemical Colors in Rubber Products. (Technical Bulletin No. 6). Akron Chemical Co., 255 Fountain St., Akron 4, Ohio. 8½ x 11 in. 4 pp.

This technical bulletin presents a compilation of the use of chemical colors in rubber compounds. How a color compound is designed, what accelerators are used, what cure to use, masterbatch powdered colors, and volume color cost are some of the topics covered. The bulletin is bound in handy loose-leaf style.





Above: The "business end" of the "Magnetic" Schuster Gage; prevents major losses of time and materials by keeping constant automatic control on thickness.

Left: The "Magnetic" Control Meter; automatically corrects the mill for any variation from required thickness, eliminates the human element.

How to control thickness continuously and accurately

Most mill men now agree that the only sure way to control the thickness of rubber, plastic, and other non-magnetic materials during processing is through CONTINUOUS GAGING. *Anything short of continuous gaging is makeshift, wasteful, expensive.*

Ideal device for continuous gaging is the "Magnetic" Schuster Gage, now a product of Pratt & Whitney. The Schuster Gage never lets the thickness pass beyond the limits without corrective action. Once installed, it is easily and quickly adjusted to the desired thickness, holds it as set right through to the end of the run. Rugged, simple; virtually no parts to wear out or be replaced.

Each installation is planned for the particular machine. Let us analyze your requirements; no obligation. Write for new descriptive literature.

PRATT & WHITNEY
***Division* Niles-Bement-Pond Company**
West Hartford 1, Conn.

Pratt & Whitney
"Magnetic"
Schuster Gage
for positive, automatic thickness control

DC MOLD RELEASE EMULSION NO. 35

for easy release of deep cavity moldings

A really good lubricant for deep cavity molds with vertical sides is an ace-in-the-hole for any rubber fabricator. And the stakes are generally high in that kind of molding. Scrap costs are above average because of the large number of damaged parts resulting from difficult unloading.

PHOTO COURTESY TEXAS RUBBER AND SPECIALTY CORP. OF HOUSTON, TEXAS

Deep cavity moldings such as these rubber stem protectors for oil well drills are more easily unloaded from molds sprayed with a dilute solution of DC Mold Release Emulsion No. 35.

The Texas Rubber and Specialty Corp. of Houston specializes in parts molded of neoprene and Buna N for oil well drilling and pumping equipment. Their engineers have found that the use of DC Mold Release Emulsion No. 35 is one of the simplest ways to reduce scrap and improve appearance.

Proof of the effectiveness of this silicone mold lubricant is the easy release of drill stem protectors molded for the Rubber Sleeve Specialty Company of Oklahoma City. These stem protectors measure 7½" in height with an outside diameter of 4 1/16", an inside diameter of 2" and a 2⅜" bevel on both ends. That's a tough assignment for any mold lubricant. But, it's on the tough unloaders that DC Mold Release Emulsion No. 35 more clearly demonstrates its superiority to any other type of mold lubricant.

DC Mold Release Emulsion No. 35 does not break down at molding temperatures. Consequently, clean molds stay clean 5-20 times as long. It readily wets metal molds and forms a heat-stable parting surface. That's why most rubber companies are consistent users of DC Mold Release Emulsion No. 35.

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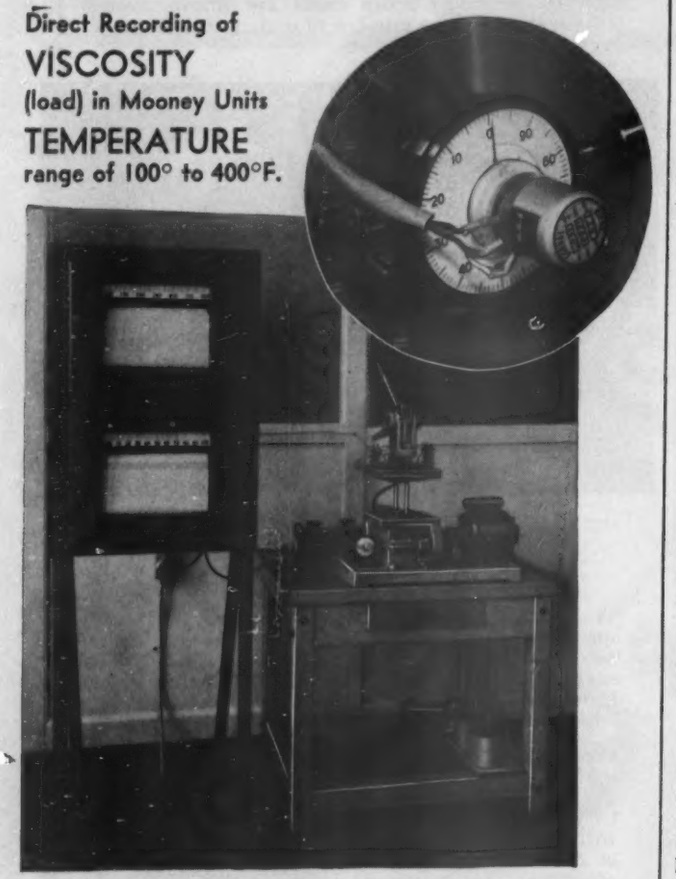

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REVIEWS (CONT'D)

Electrical Process Control. (Bulletin No. 6148). Process Control Division, Richardson Scale Co., Clifton, N. J. 11 x 8½ in. 12 pp.

A wide range of applications of automatic electrical process controls is described in this bulletin. Dealing primarily with the problem and solution by automatic control of large scale foundry operations, the bulletin also describes and illustrates master panels which are controlling processes in proportioning ingredients for rubber, plastics, etc. Structural features of the panels and scales are offered.

•

Model 40 Corrosion Resisting Durcopumps. (Bulletin No. 815). Duriron Co., Inc., Dayton 1, Ohio. 8½ x 11 in. 20 pp.

The newest design features and completely exploded views of all parts of the Model 40 Series M pumps are presented in this bulletin. Detailed information is given on such accessories and modifications as packing, lubricant, vertical seals, water-jacketed stuffing boxes, strainers, claw impellers, etc. The bulletin also outlines a method for pump testing procedures. Photographs are included.

•

L & N Pneumatic Control. (Catalog ND4B). Leeds & Northrup Co., 4907 Stenton Avenue, Philadelphia 44, Penna. 8½ x 11 in. 24 pp.

The air-actuated control system offered by L & N Pneumatic control is presented in this well-illustrated catalog. Diagrams and test curves show the manner in which the system provides proportional action and automatic droop-correction as well as stabilized rate action. Design features are also illustrated. Instruments covered in the catalog include round chart and strip-chart models.

•

Silicone Note Book. (Fluid Series Number 3). Dow Corning Corp., Midland, Mich. 8½ x 11 in. 36 pp.

Comprehensive information on the properties and behavior of DC 200 Silicone Fluids is included in this booklet. The chemical structure of the fluids is described as are the applications to which they may be put. General properties of these liquid methyl silicones are discussed as to chemical behavior, stability, solubility, lubricity, conductivity, etc. Photographs, charts and graphs are included.

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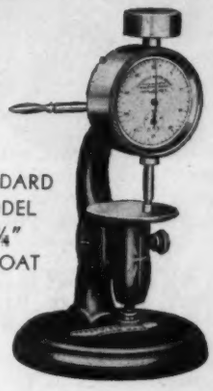
Philology?

SEE PAGE 410

RANDALL & STICKNEY

THICKNESS GAUGES FOR RUBBER



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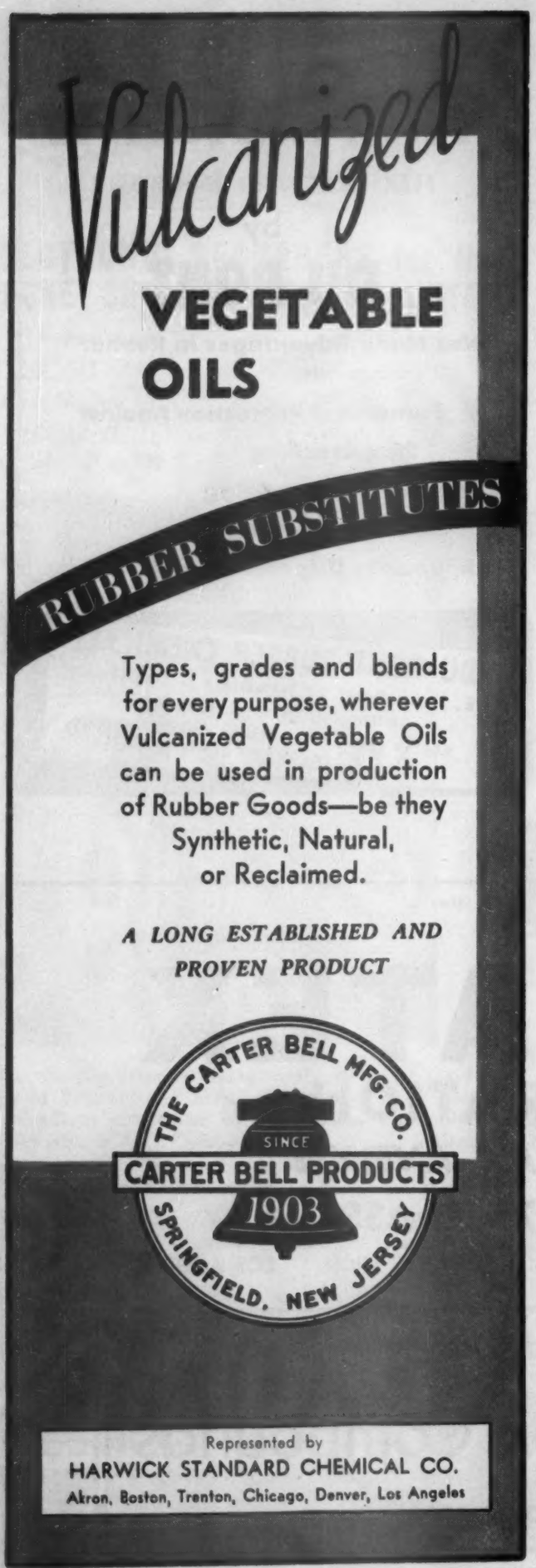
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REVIEWS (CONT'D)

Compounding with Vistac No. 1. Advance Solvents and Chemical Corp., 245 Fifth Ave., New York 16, N. Y. 9 x 12 in. 48 pp.

Containing the results of a comprehensive survey which has been underway at the company's laboratory for many months, this booklet indicates the typical effects of Vistac No. 1, a plasticizer, in a number of natural and synthetic rubber compounds, with physical test data given in each instance. Among specific compounds shown and discussed are those covering white sidewalls, tire repair materials, inner tubes, water hose, bathing caps, bathing shoes, water bottles, bulbs, bumpers, soles, sponge rubber, and wire insulation. Specific advantages of Vistac No. 1 are outlined and physical properties of the plasticizer are given.

•

Causes of Industrial Peace Under Collective Bargaining. (Case Study No. 3). National Planning Association, 800 21st St., N.W., Washington, D. C. 6 x 9 in. 98 pp. $1.00.

This report, third in NPA's scheduled series of 15, describes the nine-year growth of a healthy working relationship between the Dewey and Almy Chemical Co. and the International Chemical Workers Union, (AFL). The report analyzes the gradual evolution of the present employer-employee relationship, and discusses each step in the attainment and maintenance of satisfactory labor-management relations. A statement by the NPA committee points out the significance of the findings and relates them to the conclusions in the case studies so far issued.

•

Guidance in the Manufacture and Uses of Synthetic Resins, Polymers and Their Plastic Products. DeBell & Richardson, Inc., Hazardville, Conn. 8½ x 11 in. 24 pp.

Divided into two sections, this bulletin first discusses the function of the consulting engineer and then outlines the specific service offered by this firm of consulting engineers to industry. How the consulting engineer can aid in solving the problems of an average company is told in convenient question-and-answer form. Facilities of DeBell & Richardson at their new research and development laboratories at Hazardville, Conn., are described in text and pictures.

•

Darex Copolymer X-43. (Technical Bulletin No. C-3). Dewey & Almy Chemical Co., Cambridge, Mass. 8½ x 11 in. 12 pp.

Properties and applications of Darex Copolymer X-43, a new high styrene copolymer, are covered in this technical bulletin. The chemical composition, as well as physical and electrical properties of the material, are given. Its effect in natural rubber and GR-S and in blends of those two materials is outlined, with physical data given in each instance. Processing techniques, including suggested Banbury and mill mixing procedures, are also contained in the bulletin.

•

Barrett Storage Racks. (Bulletin 4873). Barrett-Cravens Co., 4613 South Western Blvd., Chicago 9, Ill. 8½ x 11 in. 16 pp.

Profusely illustrated with installation views of barrel and drum racks and skid racks, this bulletin shows the manner in which storage capacity can be multiplied by utilizing overhead space efficiently. Full information on the characteristics of the company's storage racks, including arc-welded steel construction types, is given in the bulletin. Saving of floor space is also considered.

•

The Story of the Tire. (Twelfth Edition). Goodyear Tire & Rubber Co., Akron, Ohio. 6 x 9 in. 64 pp.

The twelfth edition of this popular booklet brings up to date the story of the development and the manufacture of the tire. Of primary interest to the layman, the booklet answers many questions about where natural rubber comes from, where it is grown, and how synthetic is manufactured. Attention is paid to the development and manufacture of tires designed for special purposes, such as tires for aircraft, etc.

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, JANUARY 6, 1949

Natural Rubber

The price of spot rubber on the Commodity Exchange has swung in a range of 1.12 cents since our last report (December 8, 1948), high for the period being 19.50 cents reached on December 9 and again on December 20, and low 18.38 cents on December 15. The average price of spot rubber for the month of December was 18.86 cents based on 23 trading days. This compares with an average of 20.52 cents for the month of November.

The Rubber Study Group has reported that world production of natural rubber during November, 1948, amounted to 135,000 tons. Cumulative world production during the 11-month period ending November 30 amounted to 1,382,500 tons. World consumption of rubber during November amounted to 127,500 tons, and for the 11-month period, 1,277,500 tons.

A prime topic of discussion in the crude rubber market of late has been the Indonesian situation. How much damage will be done as a result of the scorched earth policy which Indonesians have been urged by their leaders to adopt, is, of course, an unknown quantity. It is, however, generally conceded that there has been an accumulation of good-sized quantities of rubber in the last quarter of this year which eliminates the probability of any extended shortage of rubber supplies from Indonesia in early 1949.

With the advent of the new year, the usual expressions of hope and confidence were heard in leading rubber quarters. Barring untoward developments in the Far East and elsewhere, rubber supplies should be plentiful and should influence an average price structure, basis No. 1 Ribbed Smoked Sheets, of under the 18½c level for GR-S.

Today's quotations in the outside market, London and Singapore, follow:

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.19⅛
January	.19⅛
February	.19
Thin Latex Crepe:	
Spot	.22¾
January	.22¾
Thin Brown Crepe, No. 2	.15¼
Ambers, No. 3	.15¼
Flat Bark Crepe	.12⅛

London Market

(Standard Smoked Sheets)

April-June	19.16 - 19.37
July-September	18.13 - 18.33

Singapore Market

(Standard Smoked Sheets)

January	15.52 - 17.63

Synthetic Rubber

(Dry Types-Per Pound)

Butaprene NF	.390 - .415
Butaprene NL	.400 - .425
Butaprene NAA	.440 - .465
Butaprene NXM	.470 - .495
Chemigum 30 N4NS	.400 - .470
Chemigum 50 N4NS	.400 - .470
Chemigum N3	.450 - .520
Hycar OR-25	.400 - .425
Hycar OR-15	.470 - .495
Hycar OS-10	.400 - .425
Neoprene Type E	—— - .650
Neoprene Types CG and AC	—— - .500
Neoprene Types FR and KNR	—— - .750
Neoprene Type S	—— - .320
Perbunan 18	.430 - .450
Perbunan 26	.440 - .460
Perbunan 35	.510 - .530
Silastic (compounded)	.235 - .440
Thiokol Type A	.370 - .470
Thiokol Type ST	.750 - .850
Thiokol Type FA	.520 - .620
Thiokol PR-1	.750 - .850

Scrap Rubber

As has been the case for the past few months, the demand for scrap rubber remains at a rather quiet level. Monetary problems in Europe and the Far East still seem to be causing apathetic export conditions, and trade circles are of the opinion that any considerable gain in business conditions must come from the export of scrap rubber. The price structure remains the same. Current quotations follow:

(Prices to Consumers, Delivered Akron)

Mixed passenger tires	ton	$12.00
Beadless truck tires	ton	nom.
Mixed truck tires	ton.	12.00
Beadless passenger tires	ton	nom.
No. 1 passenger peelings	ton	42.50
No. 1 truck peelings	ton	42.50
Red passenger tubes	lb.	.06¼
Black passenger tubes	lb.	.03½
Mixed passenger tubes	lb.	.03¾
No. 2 truck tubes	lb.	nom.
Red truck tubes	lb.	.06
Black truck tubes	lb.	.03
Buffings	ton	15.00

Reclaimed Rubber

Preliminary estimate for the consumption of reclaim during November, 1948, was set at 22,144 tons, compared with the 23,512 tons consumed during October. Consumption for the first eleven months of 1948 totaled 252,046 tons. The demand for reclaim continues brisk, and prospects for continuing demand seem good. Prices for reclaim have not changed during this past period. Current quotations follow:

Tires

Black, Acid	lb.	.08¾ - .09¼
Black, Digester	lb.	.08½ - .09
Peels	lb.	.09 - .09½
GR-S Whole Tire	lb.	.08½ - .09

Inner Tubes

Black	lb.	.12¾ - .13¼
Red	lb.	.13½ - .14½
GR-S	lb.	.10¼ - .10¾
Butyl	lb.	.08½ - .09

Shoe

Unwashed	lb.	.08¼ - .08¾

Cotton Tire Fabrics

There were no changes evidenced in the tire fabric market during the past period. The general demand for cotton tire fabrics remains at a consistently low level. As has been the case for the past few months export demand has been slowed due to foreign dollar exchange difficulties. There have been no changes in current price quotations, and these prices are expected to hold in the foreseeable future. Current quotations follow:

Standard, Peeler, 12/4/2	lb.	.74
Standard, Peeler, 14/4/2	lb.	.76
Standard, Peeler, 16/4/3	lb.	.7850
Extra Staple, Peeler, 12/4/2	lb.	.8315
Extra Staple, Peeler, 14/4/2	lb.	.8575
Extra Staple, Peeler, 16/4/3	lb.	.8825

Chafers

14.4 oz. (per sq. yard)	lb.	.7400
9.25 oz. (per sq. yard)	lb.	.6975
11.65 oz. (per sq. yard)	lb.	.6700
8.9 oz. (per sq. yard)	lb.	.7125

Cotton

The price of middling uplands on the Cotton Exchange has swung in the narrow range of .40 cents since our last report (December 8), high for the period being 33.14 cents reached on December 27, and low 32.74 cents on December 9. The average price of middling uplands for the month of December was 32.90 cents based upon 26 trading days. This compares with an average of 32.15 cents for the month of November.

The consumption of cotton declined slightly during this period. The Bureau of the Census placed November consumption at 685,166 bales compared with the 759,860 bales consumed during November, 1947. Four months' consumption totaled 2,848,924 bales, against 3,029,912 bales during a similar period last year. This is at an annual rate of approximately 8,500,000 bales compared with about 9,300,000 bales last year.

In Washington, U. S. Government officials expressed the opinion that Japan's textile production is still so low compared with pre-war years, that there is no threat to American cotton producers for years to come. Meanwhile, the British are sending representatives to the United States to discuss with American interests plans to curb Japanese competition.

Raw cotton procurements to be issued in the 12 months starting next April 3, probably will continue at about the same rate during the first year of the foreign aid program for European countries, the National Cotton Council predicted recently. The Council said that the amount of cotton to be shipped to China during that period was still unsettled due to political difficulties in that area.

Quotations for middling uplands on the Exchange follow:

	Dec. 8	January 6		
	Close	High	Low	Close
March	32.33	32.36	32.25	32.36
May	32.29	32.19	32.05	32.19
December	32.11	28.61	28.47	28.56

Closing Rubber Prices on New York Commodity Exchange

FROM DECEMBER 9 TO JANUARY 6

Date Dec.	Spot	Mar.	May	July	Sept.	Sales
9	19.50	19.10	19.00	18.95	18.85	233
10	19.00	18.90	18.70	18.65	18.50	137
11	——	——	——	——	——	——
12	——	——	——	——	——	——
13	19.38	19.15	19.05	18.85	18.75	52
14	19.00	18.80	18.70	18.55	18.35	43
15	18.38	18.25	18.12	18.00	17.90	151
16	18.50	18.30	18.25	18.15	18.00	56
17	19.00	18.75	18.60	18.53	18.42	211
18	——	——	——	——	——	——
19	——	——	——	——	——	——
20	19.50	19.03	18.94	18.83	18.68	69
21	19.00	18.50	18.47	18.35	18.25	84
22	19.00	18.65	18.60	18.50	18.25	27
23	19.00	18.65	18.60	18.45	18.25	35
24	19.00	18.65	18.60	18.45	18.25	4
25	——	——	——	——	——	——
26	——	——	——	——	——	——
27	19.00	18.60	18.55	18.40	18.20	5
28	18.88	18.60	18.45	18.35	18.20	55
29	18.88	18.60	18.46	18.35	18.20	8
30	18.75	18.41	18.26	18.15	18.01	71
31	19.00	18.80	18.65	18.50	18.35	40
Jan.						
1	——	——	——	——	——	——
2	——	——	——	——	——	——
3	19.12	19.05	18.95	18.70	18.50	27
4	19.00	18.95	18.85	18.70	18.30	77
5	19.12	18.95	18.85	18.65	18.35	32
6	19.25	19.10	18.85	18.70	18.55	58

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS												
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule				RE-EXPORTS		TOTAL NET IMPORTS
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,899	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,620	125,357,730	14.07	11,878	4,147,318	15.59	2,485	623,819	11.21	411,983	5,652	1,799,124	406,331
1939	469,803	167,558,245	15.92	27,438	10,467,552	17.03	2,232	463,345	9.27	499,473	13,125	5,832,618	486,348
1940	780,820	303,117,726	17.33	33,789	14,593,466	19.28	3,634	758,007	9.31	818,243	7,060	3,197,136	811,183
1941	989,329	401,890,393	18.14	34,798	15,965,627	20.48	4,881	1,145,767	10.48	1,029,008	5,376	2,757,872	1,023,632
1942	265,980	112,377,896	18.86	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,149	10,856	5,913,386	271,293
1943	50,348	31,364,033	27.81	1,890	1,312,202	30.99	7,679	3,636,789	21.14	59,917	22,587	16,446,707	37,330
1944	103,820	73,908,389	31.78	3,091	2,092,211	30.22	6,700	3,351,233	22.33	113,611	9,739	8,712,695	103,872
1945	134,454	95,850,441	31.82	4,773	3,115,853	29.14	10,040	5,963,797	26.52	149,267	9,509	7,201,746	139,758
1946	366,415	222,552,939	27.12	8,421	5,843,085	30.98	5,344	2,859,246	23.89	380,180	7,711	5,331,954	372,469
1947	690,954	306,919,456	19.83	17,722	9,820,080	24.91	2,880	1,492,825	20.30	711,556	4,122	2,354,494	707,434
1947:													
Jan.	92,459	51,035,472	24.64	.....	.....	....	315	169,081	23.65	.....	20	16,644	.....
Feb.	57,771	30,580,942	23.63	2,426	1,550,499	28.52	481	256,760	23.84	60,678	1,991	1,149,953	58,687
Mar.	35,128	19,421,550	24.46	496	324,103	29.15	463	246,573	23.76	36,087	39	23,592	36,048
Apr.	45,453	23,627,600	23.21	34	26,754	34.84	524	282,941	24.09	46,011	26	20,725	45,985
May	91,918	47,208,658	22.93	763	442,050	25.87	345	186,201	24.11	93,026	14	9,169	93,012
June	62,346	28,339,739	20.29	2,825	1,642,417	25.95	554	298,705	24.07	65,725	47	22,998	65,678
July	56,080	22,379,698	17.08	1,407	855,454	25.09	74	27,458	16.55	57,561	421	226,777	57,140
Aug.	43,637	16,127,766	16.93	1,784	960,877	24.48	104	24,768	18.54	45,525	191	118,666	45,334
Sept.	45,724	14,589,611	14.24	516	324,206	27.12	44	10,414	15.29	46,284	174	95,640	46,110
Oct.	46,898	14,819,306	13.11	3,081	1,370,242	19.85	....	.....	....	49,979	134	.64,620	49,665
Nov.	48,952	16,962,935	15.46	1,994	1,042,644	23.13	....	.....	....	50,946	514	289,752	50,432
Dec.	69,158	24,458,323	15.21	2,438	1,280,834	23.45	....	.....	....	71,596	371	215,958	71,225
1948:													
Jan.	76,723	29,782,199	17.33	4,130	2,044,850	22.11	....	.....	....	117,906	334	206,103	117,572
Feb.	51,528	21,027,604	18.06	2,400	1,420,676	26.43	43	10,235	10.53	53,971	290	170,339	53,681
Mar.	68,848	27,902,550	18.09	3,148	1,730,014	24.02	25	6,845	10.05	72,021	467	215,156	71,554
Apr.	38,433	15,136,536	17.35	2,284	1,260,932	24.65	30	7.076	10.53	40,747	343	190,815	40,404
May	37,227	14,409,747	17.28	3,442	1,915,744	24.84	40	9,435	10.53	40,709	1,031	485,941	39,678
June	62,376	25,338,739	18.13	2,288	1,335,173	26.05	60	14,152	10.53	64,724	718	348,043	64,006
July	60,070	25,206,980	18.07	3,654	2,002,902	24.48	100	23,587	10.53	63,734	466	243,774	63,268
Aug.	65,736	26,975,557	18.33	2,395	1,389,495	25.81	....	.....	....	67,771	520	268,912	67,251
Sept.	49,119	21,480,244	19.52	1,434	813,347	25.24	....	.....	....	50,553	514	229,016	50,039
Oct.	58,300	26,161,356	20.03	2,728	1,574,419	25.83	....	.....	....	61,028	675	320,570	60,353

Source: U. S. Department of Commerce.
Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule.

Natural Rubber
(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	488,145	575,000	12,581	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1947:				
Jan.	102,080	45,328	43	294,191
Feb.	30,318	40,983	1,253	283,479
Mar.	40,437	43,104	509	280,812
Apr.	55,976	43,818	0	292,970
May	32,738	43,018	0	330,960
June	57,055	42,329	311	345,175
July	57,243	40,389	421	131,624
Aug.	44,672	47,289	191	130,040
Sept.	46,241	50,557	174	122,097
Oct.	49,340	57,286	314	114,115
Nov.	50,840	52,076	514	110,752
Dec.	71,414	56,284	371	129,038
1948:				
Jan.	80,564	58,174	334	136,227
Feb.	54,418	51,012	290	148,081
Mar.	72,070	54,444	467	130,295
Apr.	40,947	50,616	343	123,248
May	40,709	52,022	1,031	112,724
June	64,725	55,701	718	119,818
July	63,775	48,769	466	128,446
Aug.	68,131	53,366	520	129,622
Sept.	50,556	52,131	514	123,912
Oct.	61,027	49,617	675	118,187
Nov.	50,578	51,554	500	113,090

Source: 1936-40, U. S. Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.

U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	555,643
1937	354	151,344	7,109	2,017,786	1,122	440,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,954,001	1,783	607,025
1942	1,544	1,107,059	1,200	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1947:						
Jan.	183	252,580	37	29,087	36	71,252
Feb.	270	300,828	36	44,629	17	39,679
Mar.	137	158,530	190	112,132	21	28,898
Apr.	85	106,783	178	86,923	31	48,178
May	212	208,440	524	259,745	86	164,611
June	76	63,612	83	37,314	47	88,420
July	19	24,444	287	122,677	22	50,204
Aug.	151	159,338	143	78,357	19	46,667
Sept.	86	120,633	408	192,352	18	120,633
Oct.	210	389,245	352	187,255	35	88,776
Nov.	290	302,164	148	106,443	15	53,202
Dec.	172	189,934	412	240,023	42	77,371
1948:						
Jan.	56	35,973	481	289,506	69	94,854
Feb.	145	90,023	307	209,015	66	84,839
Mar.	283	189,933	436	271,314	51	101,691
Apr.	82	36,570	651	393,280	52	68,366
May	45	36,109	512	314,432	24	54,191
June	67	36,885	277	211,373	45	41,277
July	120	87,327	205	170,949	15	35,001
Aug.	59	50,511	112	107,431	53	39,607
Sept.	91	67,970	112	83,432	0	0
Oct.	83	67,726	145	181,424	0	0

Source: U. S. Department of Commerce.

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Synthetic Rubber—Totals

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	572	1,702
1942	22,434	.....	17,651	1,419	4,612
1943	231,722	.....	170,891	18,148	41,568
1944	762,630	11,043	566,670	104,266	142,927
1945	820,373	10,407	693,580	83,778	203,454
1946	740,026	7,709	761,699*	72,920	114,963
1947	508,702	1,093	559,566	11,385	62,366
1947:					
Oct.	33,834	0	45,668	194	67,379
Nov.	37,825	634	39,091	188	67,871
Dec.	38,134	455	43,230	358	62,366
1948:					
Jan.	39,428	1,121	43,003	416	60,290
Feb.	39,025	1,318	35,375	428	65,649
Mar.	43,940	1,769	38,222	383	72,885
Apr.	40,846	.....	34,632	563	78,722
May	42,866	.....	35,268	367	85,734
June	41,207	.....	39,204	264	89,088
July	41,267	9	34,511	257	96,140
Aug.	39,630	3,599	39,339	276	97,197
Sept.	37,890	2,403	39,215	628	98,246
Oct.	41,419	2,014	38,367	451	102,842
Nov.	40,913	1,901	37,512	365	107,459

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures shown include the output of both government and privately-owned plants. (3) Figures for 1941 are estimated. * Includes year-end adjustment of 5,384 tons to cover non-reporting companies.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)	GR-I (Butyl)	Buna N Types	Total
1942	3,721	8,956	23	9,734	22,434
1943	182,259	33,603	1,373	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378	7,871	830,780
1946	613,408	47,766	80,823	5,738	747,735
1947	408,858	31,495	62,824	6,618	509,795

Consumption

1942	2,579	6,833	22	8,217	17,651
1943	131,977	26,205	304	12,405	170,891
1944	495,552	46,243	10,763	14,112	566,670
1945	600,145	42,394	43,012	8,029	693,580
1946	632,126	44,357	79,228	5,988	761,699
1947	448,589	37,703	68,838	4,536	559,666

Exports

1942	222	1,037	....	160	1,419
1943	14,937	2,540	46	631	18,148
1944	98,380	4,799	530	557	104,266
1945	76,555	5,837	980	406	83,778
1946	68,763	2,642	495	1,020	72,920
1947	7,951	2,617	62	755	11,385

Stocks at End of Period

1942	1,050	1,786	4	1,772	4,612
1943	30,975	6,415	1,035	3,143	41,568
1944	116,130	11,739	9,892	5,166	142,927
1945	170,571	9,703	18,378	4,802	203,454
1946	81,483	10,470	19,478	3,532	114,963
1947	40,606	5,237	13,184	3,339	62,366

Source: Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (2) Figures for GR-M and Buna N Types include production of privately-owned plants.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1941	1942	1943	1944	1945	1946	1947	1948
Jan.	46,190	49,216	36,085	47,540	52,008	51,746	57,057	61,308
Feb.	42,782	42,666	36,274	47,754	48,856	47,654	50,551	56,487
Mar.	49,572	50,820	41,586	52,263	55,364	56,703	59,947	68,171
Apr.	55,879	49,554	48,177	50,005	59,024	62,111	64,140	72,183
May	60,121	53,212	49,828	54,230	60,748	66,800	70,865	77,186
June	59,062	50,077	53,325	54,266	60,580	63,247	71,329	78,044
July	63,906	54,606	49,867	55,119	66,170	60,076	73,441	81,428
Aug.	63,575	48,793	51,880	55,618	70,058	66,729	72,089	80,351
Sept.	59,768	50,093	49,707	56,318	64,529	62,268	71,384	76,159
Oct.	58,412	50,094	53,111	53,154	55,708	66,637	73,277	75,164
Nov.	54,670	50,729	50,703	54,967	53,543	61,345	64,158	.....
Dec.	53,568	39,250	48,695	52,250	49,745	61,101	67,285	.....
Total	667,505	589,110	568,238	633,482	696,333	735,417	795,535	.....

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption Tons	Consumption % to Crude [a]	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007[b]	254,820	64.6	30,405	42,532
1943	304,058[c]	291,082	59.6	15,678	46,201
1944	260,631[d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1947:					
May	25,408	21,908	23.1	1,271	37,145
June	24,144	21,283	25.0	1,200	39,598
July	21,252	20,433	26.8	1,052	39,704
Aug.	21,658	21,093	24.4	1,414	40,130
Sept.	22,561	23,801	25.6	902	38,461
Oct.	25,648	26,735	26.3	1,016	36,643
Nov.	23,145	23,425	25.7	1,339	36,347
Dec.	25,123	25,229	25.4	1,437	35,943
1948:					
Jan.	25,634	25,885	25.5	768	36,307
Feb.	23,678	22,374	25.9	1,273	38,444
Mar.	24,089	24,362	26.0	937	38,313
Apr.	21,802	22,322	26.2	1,049	37,946
May	21,043	21,975	25.2	948	36,612
June	22,504	23,786	25.1	925	35,898
July	17,712	19,291	23.2	712	34,302
Aug.	20,255	22,917	24.7	643	32,025
Sept.	21,805	23,478	25.7	740	30,198
Oct.	23,859	23,512	26.7	848	31,879
Nov.	22,809	23,144	24.9	800	33,530

Source: 1936-40, Department of Commerce; 1941 to date, Rubber Division, OMD, and Predecessor Agencies.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. ([a]) Includes natural and synthetic rubber. ([b]) Includes 893 tons of imports. ([c]) Includes 67 tons of imports. ([d]) Includes 21 tons of imports.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1930	2,784,745	571,241	3,355,986	1939	2,866,796	704,308	3,571,104
1931	1,973,090	416,648	2,389,738	1940	3,692,328	721,637	4,413,965
1932	1,135,491	235,187	1,370,678	1941	3,744,500	875,381	4,619,681
1933	1,573,512	346,545	1,920,057	1942	220,814	133,083	353,897
1934	2,177,919	575,192	2,753,111	1943	0	4,501	4,501
1935	3,252,244	694,690	3,946,934	1944	0	124,819	124,819
1936	3,669,528	781,862	4,451,390	1945	83,792	313,643	397,435
1937	3,915,889	892,382	4,808,271	1946	2,148,699	930,760	3,079,459
1938	2,000,985	485,852	2,486,837	1947	3,558,178	1,220,634	4,778,812
1947:							
Jan.	246,605	99,818	346,423	July	279,631	97,814	377,445
Feb.	267,015	105,042	372,057	Aug.	261,158	86,509	347,667
Mar.	301,525	118,234	419,759	Sept.	307,942	110,720	418,662
Apr.	314,765	106,984	421,749	Oct.	315,969	118,365	434,334
May	284,357	96,430	380,787	Nov.	305,148	87,611	392,759
June	307,124	91,810	398,934	Dec.	366,939	101,569	468,508
1948:							
Jan.	305,081	99,200	404,281	July	356,764	116,780	473,544
Feb.	274,847	107,054	381,901	Aug.	348,782	111,760	460,542
Mar.	349,998	140,606	490,604	Sept.	301,170	111,224	412,394
Apr.	308,071	128,963	437,034	Oct.	383,756	107,352	491,108
May	225,461	111,789	337,250	Nov.	364,870	103,837	468,707
June	312,406	117,572	429,978	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1943	1944	1945	1946	1947
Passenger Car	780,291	1,748,917	4,504,368	15,058,469	21,346,004
Truck & Bus	4,949,004	6,391,441	6,486,652	5,939,244	7,737,353
Agricultural	301,997	997,301	1,441,909	1,735,992	2,633,699
Earth Mover	945	703	1,308	5,520	10,610
Total	6,032,237	9,138,362	12,434,237	22,739,225	31,727,666

	1948 June	July	Aug.	Sept.	Oct.	Nov.
Passenger Car	2,090,787	2,101,695	2,164,158	1,787,181	1,948,651	2,078,140
Truck & Bus	580,067	579,616	501,308	505,616	505,452	529,768
Agricultural	235,403	236,705	208,471	327,644	230,830	263,785
Earth Mover	1,317	1,066	352	1,635	394	935
Total	2,907,574	2,919,082	2,874,289	2,621,576	2,685,327	2,872,628

Source: The Tire & Rim Association, Inc.

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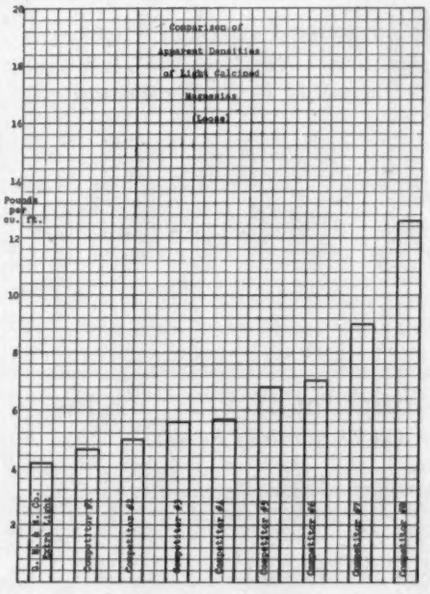

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Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1936 (total)	21,446	30,866	1,073	53,385	56,041	10,717
Passenger Car.	18,941	26,999	644	46,584	49,013	9,291
Truck and Bus	2,505	3,867	429	6,801	7,028	1,426
1937 (total)	22,353	29,886	1,246	53,485	53,310	10,383
Passenger Car.	20,055	26,177	696	46,928	46,497	8,745
Truck and Bus	2,298	3,709	550	6,557	6,813	1,638
1938 (total)	11,516	30,567	1,049	43,132	40,907	8,451
Passenger Car.	10,086	27,104	580	37,770	35,789	6,937
Truck and Bus	1,430	3,463	469	5,362	5,118	1,514
1939 (total)	18,208	38,022	1,279	57,509	57,613	8,665
Passenger Car.	15,742	33,471	607	49,820	49,933	7,108
Truck and Bus	2,466	4,551	672	7,689	7,680	1,557
1940 (total)	22,252	35,346	1,176	58,774	59,186	9,127
Passenger Car.	19,560	30,903	411	50,874	50,965	7,270
Truck and Bus	2,692	4,443	765	7,900	8,221	1,857
1941 (total)	24,780	39,895	1,489	66,164	61,540	4,436
Passenger Car.	19,855	34,119	586	54,560	50,392	3,165
Truck and Bus	4,925	5,776	903	11,604	11,148	1,271
1942 (total)	6,680	8,872	207	15,759	15,351	6,247
Passenger Car.	910	2,734	38	3,682	2,790	4,432
Truck and Bus	5,770	6,138	169	12,077	12,561	1,815
1943 (total)	6,128	18,547	225	24,900	20,423	1,883
Passenger Car.	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	6,654	26,439	263	33,356	33,446	2,013
Passenger Car.	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	5,984	36,479	504	42,967	44,524	3,077
Passenger Car.	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	15,310	65,490	1,512	82,312	82,298	2,448
Passenger Car.	11,086	54,684	653	66,423	66,466	1,763
Truck and Bus	4,224	10,806	859	15,889	15,832	685
1947 (total)	25,055	62,890	3,249	91,194	95,548	6,975
Passenger Car.	19,644	52,865	1,608	74,117	77,790	5,470
Truck and Bus	5,411	10,025	1,642	17,077	17,758	1,505
1948:						
July (total)	2,379	5,357	131	7,866	6,672	10,207
Passenger Car.	1,928	4,592	41	6,560	5,516	8,254
Truck and Bus	451	765	90	1,306	1,156	1,953
Aug. (total)	2,290	5,409	136	7,835	6,963	9,335
Passenger Car.	1,884	4,637	55	6,576	5,769	7,463
Truck and Bus	406	772	81	1,259	1,194	1,873
Sept. (total)	2,114	4,460	126	6,700	6,915	9,805
Passenger Car.	1,718	3,771	42	5,531	5,740	7,848
Truck and Bus	396	689	84	1,169	1,174	1,957
Oct. (total)	2,436	3,899	156	6,492	6,750	9,905
Passenger Car.	2,043	3,175	56	5,276	5,560	8,002
Truck and Bus	393	724	99	1,216	1,190	1,903

Source: The Rubber Manufacturers Association, Inc.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton				Rayon and Nylon [b]		
	Tire Cord Not Woven	Cord Fabric Woven	Chafer and All Other Tire Fabrics	Total	Tire Cord Not Woven	Tire Cord And Other Tire Fabrics	Total
1945:							
Jan.-Mar.	16,671	43,835	12,306	72,812	3,726	37,777	41,503
Apr.-June	16,044	42,383	13,604	72,031	4,064	42,476	46,540
July-Sept.	15,136	38,158	14,122	67,416	3,549	42,606	46,155
Oct.-Dec.	15,514	36,442	13,573	65,529	a	47,734	47,734
Total	63,365	160,818	53,605	277,788	11,339	170,593	181,932
1946:							
Jan.-Mar.	17,128	39,377	15,245	71,750	a	51,208	51,208
Apr.-June	19,622	40,197	18,623	78,442	a	52,511	52,511
July-Sept.	17,279	39,259	18,787	75,325	5,102	46,932	52,034
Oct.-Dec.	20,660	42,668	21,708	85,036	5,858	50,589	56,447
Total	74,689	161,501	74,363	310,553	10,960	201,240	212,200
1947:							
Jan.-Mar.	21,972	49,377	21,815	93,164	5,322	52,059	57,381
Apr.-June	23,491	53,746	16,480	93,717	5,486	47,360	52,846
July-Sept.	15,571	44,291	14,596	74,458	6,161	51,719	57,880
Oct.-Dec.	18,183	48,532	17,762	84,477	6,550	55,078	61,628
Total	79,217	195,946	70,653	345,816	23,519	206,216	229,735
1948:							
Jan.-Mar.	18,546	50,251	19,391	88,188	a	60,569	60,569
Apr.-June	15,585	45,385	18,213	79,183	a	59,759	59,759
July-Sept.	29,865	45,927	c	75,792	a	63,642	63,642
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: U. S. Bureau of the Census.

Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. (c) Included with tire cord not woven.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1936	21,514	32,188	721	54,423	57,036	10,945
1937	22,464	29,554	749	52,767	52,373	10,312
1938	11,515	28,134	644	40,293	37,848	8,166
1939	18,190	31,998	1,002	51,190	50,649	7,036
1940	22,172	29,070	972	52,214	52,237	7,017
1941	24,722	33,749	1,232	59,703	57,433	4,686
1942	n.a.	n.a.	n.a.	13,958	12,568	5,742
1943	6,183	12,373	176	18,732	15,260	2,584
1944	6,461	19,739	190	26,390	26,750	2,823
1945	6,119	33,161	408	39,688	41,102	3,671
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,039	49,107	2,496	76,641	75,509	8,089
1948:						
Mar.	2,363	2,731	94	5,188	5,534	9,930
Apr.	2,264	3,456	88	5,807	5,578	9,737
May	1,814	3,516	89	5,419	5,702	10,069
June	2,218	4,421	107	6,745	6,716	9,939
July	2,365	4,365	78	6,807	5,750	8,760
Aug.	2,292	4,522	103	6,917	6,639	8,533
Sept.	2,112	4,007	81	6,200	6,191	8,778
Oct.	2,432	3,537	91	6,061	6,323	8,915

Source: The Rubber Manufacturers Association, Inc.
n.a.—Not available.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1930	16½	7½	11.98
1911	184	114	141.30	1931	8⅝	4¼	6.17
1912	140	108	121.60	1932	4¾	2½	3.49
1913	113	59	82.04	1933	9⅞	2⅜	5.96
1914	93	56	65.33	1934	15⅞	8¾	12.92
1915	79	58½	65.85	1935	13¾	10½	12.37
1916	102	55	72.50	1936	23	13½	16.41
1917	90	52	72.23	1937	26⅞	14	19.39
1918	70	40	60.15	1938	17⅞	10¼	14.64
1919	57	38½	48.70	1939	24	14⅛	17.57
1920	56½	16	36.30	1940	24	18¾	20.10
1921	21¾	11½	16.36	1941	24⅞	19¾	22.40
1922	28½	13⅝	17.50	1942	22½	22½	22.50
1923	37½	24¾	29.45	1943	22½	22½	22.50
1924	40⅝	17⅝	26.20	1944	22½	22½	22.50
1925	121	34⅜	72.46	1945	22½	22½	22.50
1926	88½	36¾	48.50	1946	22½	22½	22.50
1927	41¾	33	37.72	1947	25	14	20.00
1928	41¾	17	22.48	1948	25	18	21.99
1929	26⅞	15½	20.55				

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1941	1942	1943	1944	1945	1946	1947	1948
Jan.	10.66	19.85	21.34	20.76	22.36	25.49	32.58	36.09
Feb.	10.87	20.05	21.61	21.34	22.29	26.57	33.91	33.63
Mar.	11.08	20.42	21.98	21.65	22.43	27.52	35.89	35.04
Apr.	11.48	21.10	22.02	21.71	21.88	28.40	35.89	38.10
May	12.97	20.88	21.97	21.63	23.30	28.17	36.51	38.57
June	14.66	19.78	21.92	23.31	23.42	29.89	37.83	38.12
July	16.55	20.27	21.46	22.33	23.27	34.11	38.03	34.89
Aug.	17.06	19.45	21.09	22.11	23.10	36.31	34.83	32.23
Sept.	17.94	19.62	21.10	22.10	23.25	37.59	32.21	31.92
Oct.	17.31	19.79	21.00	22.32	23.85	36.79	32.39	32.01
Nov.	17.21	20.21	20.32	22.13	24.71	31.50	34.50	32.15
Dec.	18.09	20.55	20.32	22.28	25.21	33.03	36.74	32.90
Average for Year	14.66	20.16	21.34	21.89	23.25	31.28	35.11	34.64

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film [a]	Textile and Paper Coating Resins [b]	Molding and Extrusion Materials [b]	All Other [b, c]
1946	52,080	11,673	61,852	27,083
1947	66,430	17,237	73,114	27,064
1948:				
Mar.	7,537	3,053	6,767	1,680
Apr.	7,468	2,938	6,725	2,066
May	6,351	2,318	5,680	1,597
June	7,194	2,089	4,312	1,594
July	6,893	2,593	4,142	1,368
Aug.	8,291	2,613	5,361	1,834
Sept.	10,298	2,924	5,920	1,845
Oct.	11,364	2,981	5,666	1,859
Nov.	10,099	2,588	6,533	2,014

Source: Bureau of the Census.

Notes: (a) Includes weight of fillers, plasticizers, extenders and safety glass sheeting; (b) Resin content; (c) Includes Adhesives, but excludes data for protective coating resins.

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Rubber Industry Employment, Payrolls, Wages and Hours

Employment — Thousands of Production Workers and Index (1939 = 100)

	1947				1948			
	All Rubber Products		Rubber Tires & Tubes		All Rubber Products		Rubber Tires & Tubes	
Month	Number	Index	Number	Index	Number	Index	Number	Index
Jan.	240	198.8	110	235.5	210	173.5	106	185.5
Feb.	240	198.2	109	233.3	208	172.0	99	182.4
Mar.	238	196.5	108	231.4	204	168.9	96	177.7
Apr.	234	193.5	106	227.0	198	163.8	93	170.7
May	223	184.5	102	220.0	195	161.1	91	168.5
June	207	170.9	106	195.1	195	161.6	92	169.4
July	200	165.1	103	186.9	191	157.7	91	167.6
Aug.	203	167.9	105	193.0	195	160.9	92	168.7
Sept.	203	168.1	101	185.2	197	162.8	91	168.6
Oct.	208	171.7	102	188.0	198	163.9	...	....
Nov.	210	174.0	102	188.7	...	....	...	....
Dec.	212	175.3	102	187.8	...	....	...	....

Note: Figures from June, 1947, to date have been revised to adjust them to levels indicated by Federal Security Agency data for 1946; revisions for January-May, 1947, will be shown later.

Payrolls — Production Workers Pay Rolls Unadjusted Index (1939 = 100)

	1946		1947		1948	
Month	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes
Jan.	290.1	272.6	386.3	416.3	354.9	344.4
Feb.	292.1	271.9	385.0	413.3	337.2	315.4
Mar.	298.2	281.1	374.3	397.3	320.6	292.4
Apr.	319.7	312.9	383.9	414.2	312.8	286.4
May	322.1	314.2	367.2	399.3	318.9	305.7
June	331.4	318.3	342.3	356.2	330.2	322.0
July	321.4	304.3	331.2	350.0	329.7	329.8
Aug.	336.9	311.2	337.6	355.5	347.2	341.0
Sept.	363.9	348.9	348.3	355.3	344.9	326.2
Oct.	361.3	346.1	354.4	354.7	....	....
Nov.	377.4	360.3	361.4	362.4	....	....
Dec.	392.2	368.9	373.6	365.6	....	....

Note: Figures from June, 1947, to date have been revised to adjust them to levels indicated by Federal Security Agency data for 1946; revisions for January, 1946, through May, 1947, will be shown later.

Wages — Average Weekly Earnings

	1946		1947		1948	
Month	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes
Jan.	$46.71	$50.29	$54.03	$59.78	$57.33	$62.72
Feb.	46.05	49.21	54.06	59.90	54.70	58.22
Mar.	46.46	49.72	52.97	58.05	53.24	55.54
Apr.	49.67	54.77	55.23	61.64	53.39	56.54
May	49.82	54.72	55.30	61.12	55.45	61.15
June	50.45	54.82	55.49	61.35	57.14	63.96
July	50.60	56.11	55.74	62.06	58.37	66.30
Aug.	51.03	55.42	55.92	61.15	60.47	68.29
Sept.	53.69	59.89	57.76	64.75	59.42	65.27
Oct.	51.74	57.38	57.62	63.78	....	....
Nov.	52.93	58.87	57.99	64.86	....	....
Dec.	54.63	60.46	59.47	65.74	....	....

Wages — Average Hourly Earnings

	1946		1947		1948	
Month	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes	All Rubber Products	Rubber Tires & Tubes
Jan.	$1.121	$1.255	$1.330	$1.511	$1.444	$1.646
Feb.	1.129	1.266	1.331	1.517	1.421	1.613
Mar.	1.138	1.275	1.330	1.512	1.408	1.599
Apr.	1.232	1.414	1.397	1.608	1.412	1.603
May	1.266	1.446	1.416	1.622	1.424	1.636
June	1.283	1.461	1.419	1.613	1.439	1.651
July	1.292	1.472	1.443	1.640	1.472	1.684
Aug.	1.295	1.474	1.445	1.640	1.502	1.730
Sept.	1.323	1.507	1.447	1.661	1.504	1.732
Oct.	1.313	1.492	1.436	1.644	....	....
Nov.	1.322	1.503	1.453	1.661	....	....
Dec.	1.331	1.513	1.454	1.658	....	....

Hours — Average Weekly Hours per Worker

Month	1946	1947	1948	Month	1946	1947	1948
January	41.7	40.6	39.7	July	39.2	38.6	39.7
February	40.8	40.6	38.5	August	39.4	38.7	40.3
March	40.8	39.8	37.8	September	40.6	39.9	39.5
April	40.3	39.5	37.8	October	39.4	40.1	...
May	39.4	39.0	39.0	November	40.1	39.9	...
June	39.3	39.1	39.7	December	41.2	40.9	...

Source: U. S. Department of Commerce. Note: These figures are revised from time to time and the latest available issue should be consulted for the most accurate data.

Indexes of Production, Shipments and Inventory For The Rubber Industry

Production 1935-1939 = 100 (Based on man-hours)

Month	1946	1947	1948	Month	1946	1947	1948
Jan.	215	247	223	July	211	207	200
Feb.	216	246	215	Aug.	221	210	207
Mar.	221	239	205	Sept.	234	217	206
Apr.	219	234	200	Oct.	234	223	210
May	215	220	201	Nov.	243	225	.....
June	218	216	205	Dec.	252	230	....

Shipments—Average Month 1939 = 100 (Based on $ Value)

Jan.	211	301	282	July	278	298	339
Feb.	214	326	289	Aug.	292	312	351
Mar.	223	332	252	Sept.	321	346	345
Apr.	291	320	312	Oct.	344	348	336
May	297	309	317	Nov.	324	354	....
June	302	322	342	Dec.	363	307	....

Inventory — Average Month 1939 = 100 (Based on $ Value)

Jan.	171	229	271	July	187	268	289
Feb.	177	241	283	Aug.	191	258	287
Mar.	183	253	302	Sept.	197	246	288
Apr.	190	270	293	Oct.	204	247	289
May	188	279	296	Nov.	207	242	....
June	185	277	295	Dec.	209	257	....

Source: U. S. Department of Commerce.

Various Compounding Materials Consumed by the Rubber Industry

Material	1941	1942	1943	1944	1945	1946	1947
Asphalt [a]							
Short tons	20,536	22,263	16,510	20,189	19,483	28,715	32,113
% of total	0.6	0.6	0.5	0.6	0.5	0.7	0.7
Barite (Barytes):							
Short tons	9,800	6,334	8,000	10,000	10,000	20,000	17,000
% of total	4.2	3.6	3.9	2.9	2.1	4.4	3.1
Carbon Black:							
Short tons	219,751	147,974	236,737	369,015	402,193	470,732	471,790
% of total	88.5	88.5	90.3	94.6	95.5	95.3	94.3
Clay, Kaolin:							
Short tons	127,0555	51,334	50,964	59,588	109,936	162,393	166,201
% of total	11.6	5.1	5.5	6.8	11.7	12.3	12.0
Clay, Fire & Stoneware:							
Short tons	9,000	5,000	10,259	7,160	7,800	12,951	.....
% of total	0.2	0.1	0.2	0.1	0.1	0.2	..
Lead Sulfate, Basic:							
Short tons	200	89	131	268	200	.....	.....
% of total	1.9	1.1	2.3	4.2	5.2	..	..
Lime:							
Short tons	3,058	1,381	2,039	5,634	7,170	3,193	.....
% of total	0.05	0.02	0.05	0.13	0.10	0.1	..
Litharge:							
Short tons	3,968	3,460	4,302	3,023	1,864	2.131	.....
% of total	3.3	3.8	3.8	2.2	1.3	1.6	..
Lithopone:							
Short tons	3,547	1,047	1,078	726	977	1,607	3,085
% of total	2.0	0.8	0.8	0.5	0.7	1.1	1.1
Mica, Ground:							
Short tons	3,476	1,754	3,063	1,137	3,715	4,951	.....
% of total	8.0	3.7	6.0	2.2	7.0	8.0	..
Sulfur:							
Short tons	63,900	40,000	51,000	63,000	64,960	72,800	.....
% of tgotal	2.4	1.4	1.8	1.9	2.0	2.2	..
Talc [b]							
Short tons	58,114	40,487	48,994	51,833	63,758*	65,980	.....
% of tgotal	13.9	10.0	11.8	13.0	16.0	14.4	..
Zinc Oxide:							
Short tons	90,429	52,717	67,898	59,518	63,447	83,776	.....
% of total	63.4	53.0	47.4	42.3	49.6	53.1	..

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes pyrophyllite and ground soapstone. * Revised.

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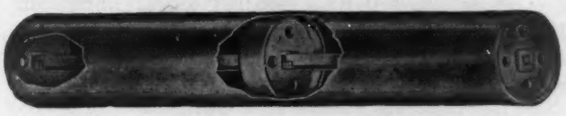

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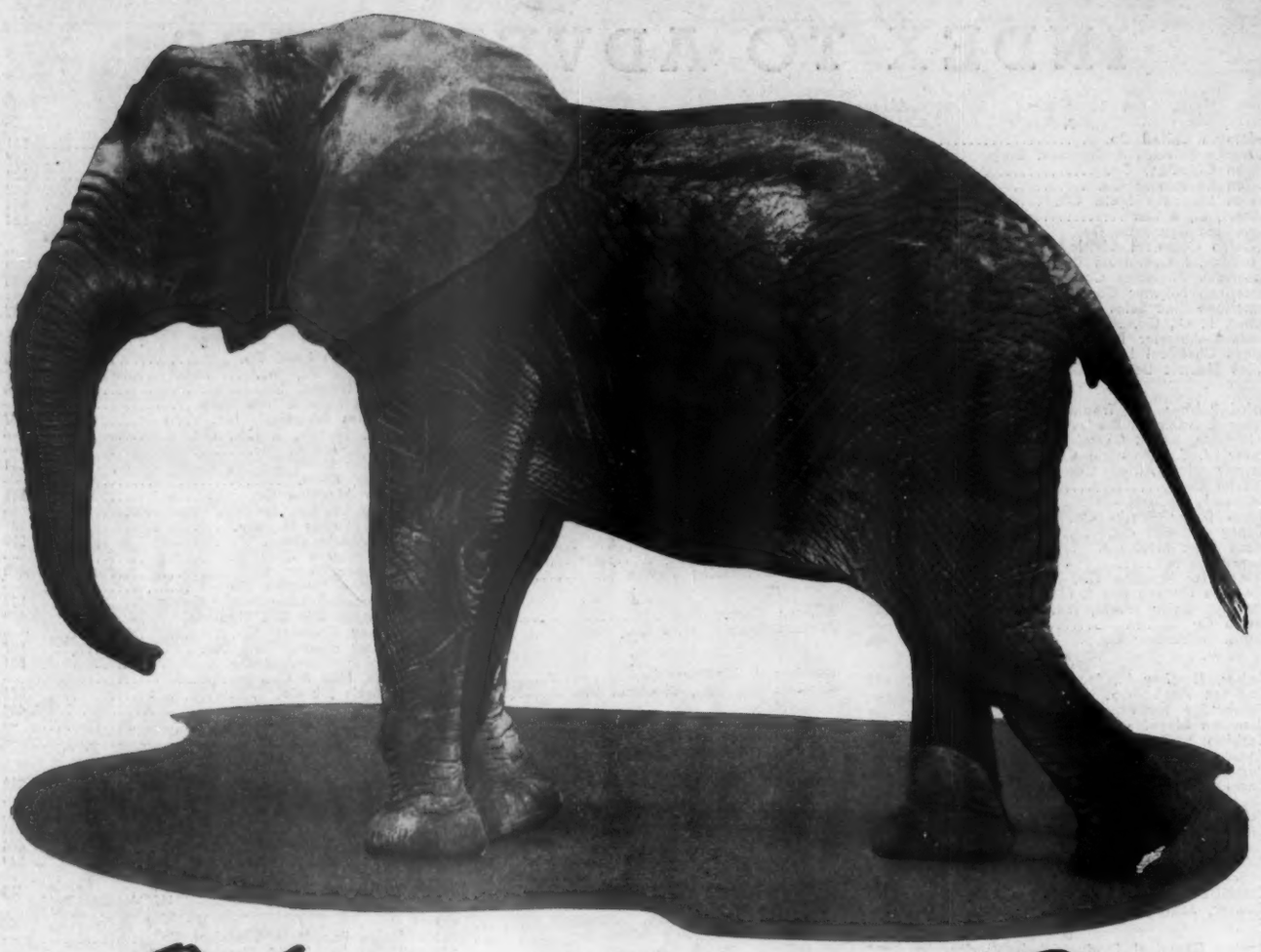

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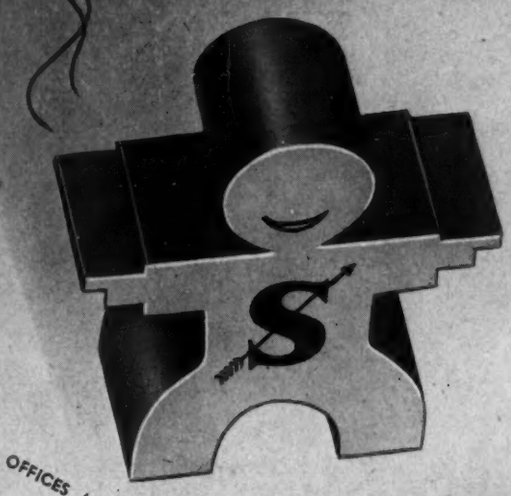
Sid Richardson
CARBON COMPANY
FORT WORTH, TEXAS

GENERAL SALES OFFICES
EVANS SAVINGS AND LOAN BUILDING
AKRON 8, OHIO

PARTIAL LIST OF

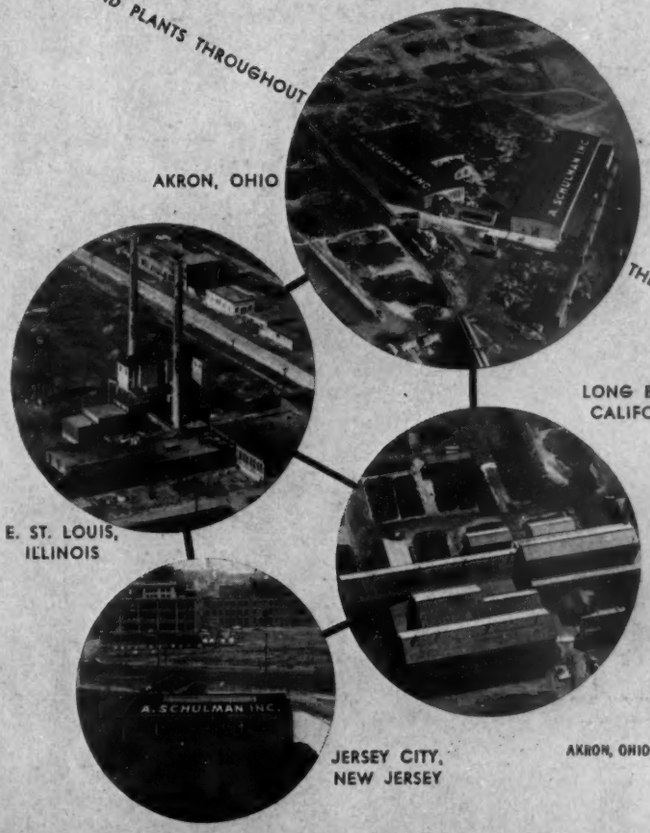
Materials Handled by A. Schulman Inc.



- ★ CURED SCRAP RUBBER FOR RECLAIMERS
- ★ CURED SCRAP RUBBER FOR ALL PURPOSES
- ★ UNCURED SCRAP RUBBER GENERAL FACTORY USE
- ★ HARD RUBBER DUST
- ★ CRUDE RUBBER
- ★ PLASTIC WASTE
- ★ MACHINERY FOR RUBBER AND PLASTICS INDUSTRY
- ★ SHIMS FOR THE AUTOMOTIVE TRADE

ALL INQUIRIES GIVEN PROMPT ATTENTION!

OFFICES AND PLANTS THROUGHOUT THE UNITED STATES TO SERVE THE WORLD



AKRON, OHIO

LONG BEACH, CALIFORNIA

E. ST. LOUIS, ILLINOIS

JERSEY CITY, NEW JERSEY

A. Schulman Inc.

Rubber and Plastics

Main Office and Plant: 790 E. Tallmadge Ave., Akron 9, Ohio

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PRODUCTION BENEFITS

- ☐ Perfect Separation of Stock and Liner
- ☐ Less Power and Labor
- ☐ Horizontal Storage, if desired
- ☐ No Cleaning of Liners
- ☐ Longer Liner Life
- ☐ Less Stock Losses

BENEFITS TO STOCKS

- ☐ No Lint or Ravelings
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- ☐ Air, Moisture & Sunlight Excluded
- ☐ Tackiness of Stock Preserved
- ☐ Gauges More Easily Maintained
- ☐ Greater Latitude in Compounding

Check these Important Advantages of

CLIMCO Processed Liners

These advantages are not mere claims, but have been demonstrated over and over by the use of Climco Processed Liners in all kinds of rubber plants during the last 27 years. Surely, in the interests of better production at less cost, Climco Liners are worthy of use in your plant.

ILLUSTRATED LINER BOOKLET

Tells all about Climco Liners and Linerette and how to get better service from liners. Write for your copy now.

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Treatment Contains
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32nd Year

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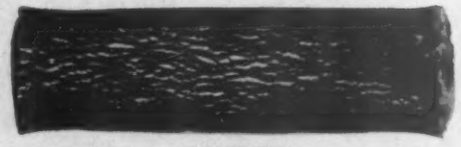
DU PONT ANNOUNCES

a valuable new compounding material

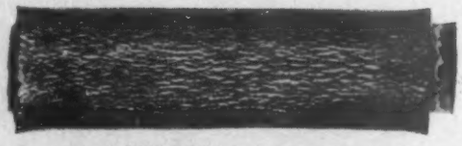
NBC

- ✓ Inhibits dynamic and static exposure cracking of GR-S
- ✓ Improves heat resistance of neoprene
- ✓ Retards sunlight discoloration of neoprene

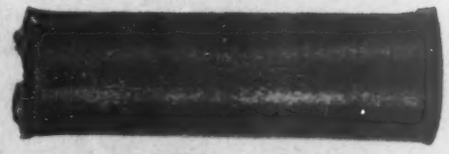
CONDITION OF GR-S SIDEWALL STOCKS AFTER 56 DAYS' OUTDOOR FLEXING IN FLORIDA



CONTROL



CONTROL + 0.5 NBC



CONTROL + 1.0 NBC

CONTROL + 2.0 NBC

Now, with Du Pont NBC, GR-S compounds can be fortified against both static and dynamic exposure cracking. The illustration proves its effectiveness in a typical GR-S tread and sidewall stock. Even after 56 days of outdoor flexing, the stock with 2.0 parts of NBC showed no cracking. The control stock began to crack after only two days' flexing.

In neoprene stocks, which do not require protection against exposure cracking, NBC is important for other reasons: It is useful for improving heat resistance. And it effectively retards sunlight discoloration in colored compounds.

Compounders will find NBC an important ingredient for broadening the usefulness of both GR-S and neoprene stocks. Complete information on its use will be found in Report 49-1.

Extra copies are available. Experimental samples on request. See your Du Pont representative or write:

DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Del.

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BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

Tune in to Du Pont "Cavalcade of America," Monday Nights—NBC Coast to Coast

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc., Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York 19, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $3.00 a year; Canada, $3.50; Foreign, $4.00. February, 1949. Vol. 64, No. 5.

To serve you in new ways . . .

another EASY PROCESSING AMERICAN RUBBER

HYCAR OR-15 EP

THE new *easy processing* Hycar rubber has superior processing characteristics that parallel those of the widely used Hycar OR-25 EP. It retains the properties of the regular process Hycar OR-15 . . . permanent resiliency and superior resistance to oil, abrasion and aging.

In addition, Hycar OR-15 EP has these basic advantages:

1. Designed for Banbury and high temperature mixing.
2. Cuts mill mixing time appreciably.
3. Less rejections due to better mold flow and fusion during cure.
4. Improved building tack for laminated products such as rolls, sheet packing and hose.

Ask your supplier to tell you about, or investigate the merits of new Hycar OR-15 EP. Or, please write to Dept. HB-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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American Rubber

B. F. Goodrich Chemical Company
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Philalethist—*Lover of truth.*

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We swear to tell the truth and nothing but the truth! This high-quality HMF black, Philblack A, has proved eminently successful in the manufacture of tires and other rubber goods. It not only makes processing easy, it also aids in obtaining smooth, facile extrusions.

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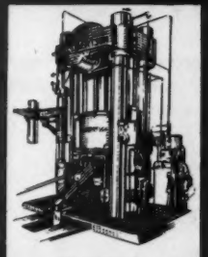
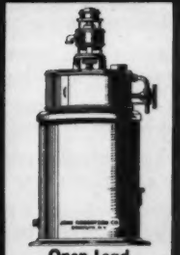
The users of Robertson equipment are leaders in the industry—turning out mile after mile of quality vulcanized hose daily. They rely on Robertson equipment . . . Hose Lead Encasing Presses, Lead Melting Pots and Lead Sheath Stripping Machines. Robertson has served this industry well for many years. "Maximum quality production—minimum maintenance and operating cost" is the byword that accounts for the increasing use of Robertson equipment by rubber companies known for their high quality products.



Hose Lead Encasing Press



Open Lead Melting Pot

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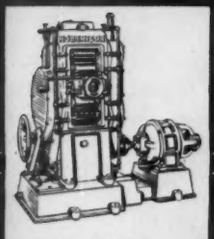
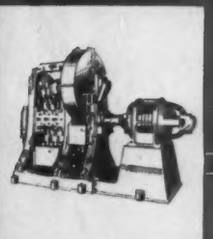
Designers and Builders of all Types of Lead Encasing Machinery

Since 1858



Lead Sheath Stripping Machine



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Indispensable TO YOU IN THE RUBBER INDUSTRY—

Gives Your Products

PROTECTION and SALES APPEAL

at Little Cost!

BEACOFINISH—a unique family of coating materials conceived to give your products greater durability and eye appeal. These highly concentrated wax emulsions that can be diluted with up to four parts of water can be used with the utmost safety and economy.

BEACOFINISH is therefore of four-fold importance to you:—

1. ***It Protects*** your products against their natural enemies—air, sunlight, moisture and excessive handling.
2. ***It Improves*** the appearance of your product for its uniform coating stimulates greater consumer interest.
3. ***It's Economical*** because its high dilution potential (without losing efficiency) allows one gallon to cover 15,000 sq. ft.
4. ***It's Safe*** being a wax in water emulsion, it eliminates the fire and health hazards of volatile-solvent based finishes.

BEACOFINISH can be applied by dipping, sponging, spraying or brushing—dries in about 20 minutes—faster if force-dried—to give a hard protective coating of great elasticity.

BEACOFINISH may be ordered in Neutral or Black, in varying degrees of luster from brilliant to dull. It is so concentrated, from one drum you can obtain potentially up to five drums of superior coating for your products.

CONSULT US—WRITE US TODAY

Let us show you how BEACOFINISH can make your products more attractive and saleable—protect them from damage—you from loss—in production and transit!

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When you need a GREEN, YELLOW or GOLD FOR PLASTICS that has excellent LIGHT RESISTANCE and FREEDOM FROM CROCKING and MIGRATION, try DU PONT GREEN-GOLD

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...THROUGH CHEMISTRY

YOU CAN GET OUTSTANDING RESULTS WITH DU PONT GREEN-GOLD

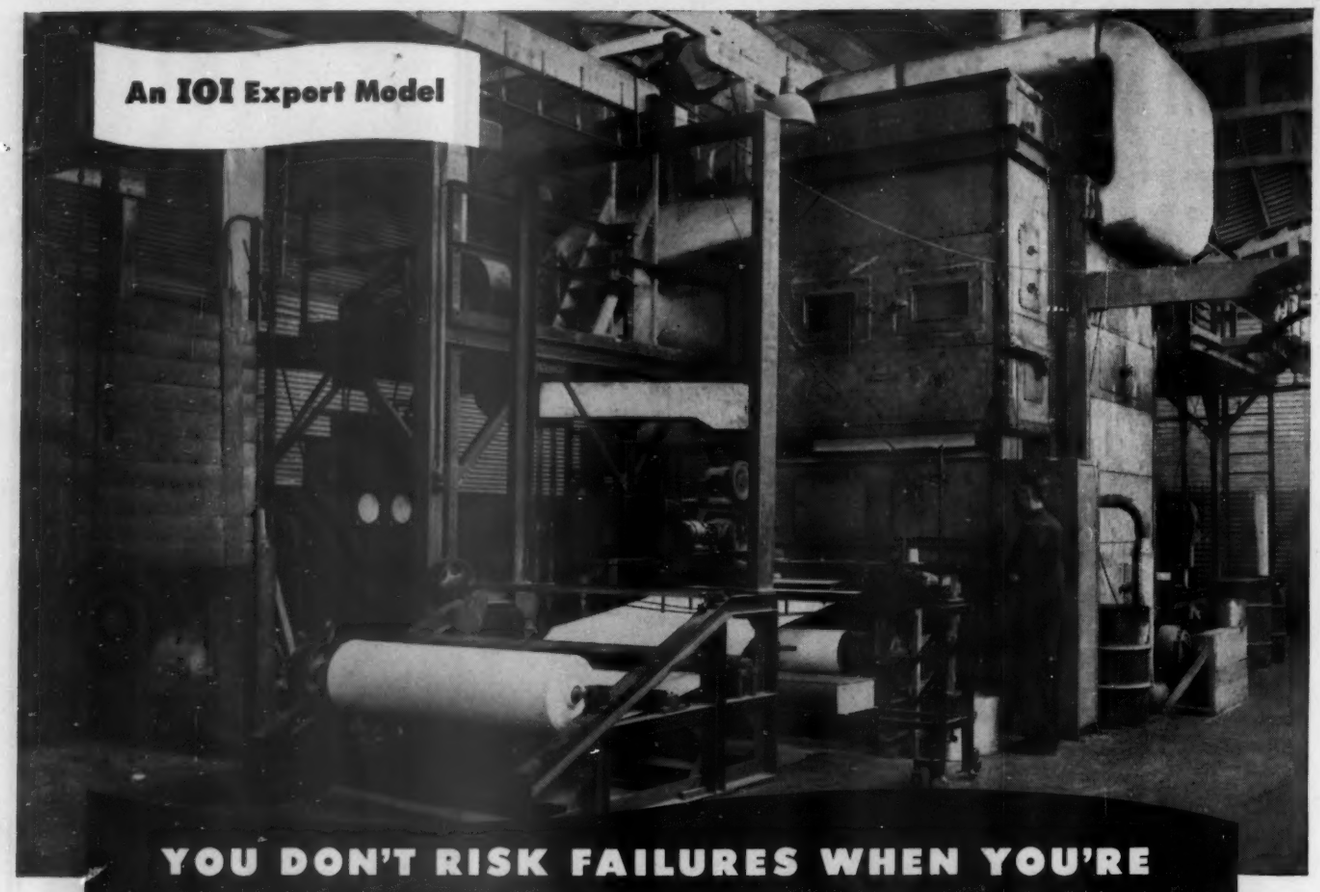
The many excellent properties of this quality pigment, such as easy dispersion... exceptional light resistance, even in low concentrations . . . resistance to heat . . . freedom from crocking, migration and bleeding... can give you profitable results in the production of fine plastic products.

Green-Gold combines with "Monastral" Green to make brilliant, lightfast green shades. And alone, or in combination with "Monastral," Green-Gold can be metallized with flake aluminum to provide striking "two-tone" effects.

For further information on this and other Du Pont pigments for rubber and plastics, ask your Du Pont salesman—or write: E. I. du Pont de Nemours & Co. (Inc.), Pigments Department, 1007 Market St., Wilmington 98, Del.

DU PONT
PIGMENTS
for Rubber and Plastics

Tune in to Du Pont "Cavalcade of America," Monday Nights—NBC Coast to Coast



YOU DON'T RISK FAILURES WHEN YOU'RE *11,000 Miles Away* FROM YOUR SOURCE OF SUPPLY

THE Olympic Tire and Rubber Co., Ltd., West Footscray, Victoria, Australia, has every reason to be extremely particular about the dependability of its tire fabric latexing machines. When you're halfway around the world from the manufacturer of such vital equipment you've got to be *sure* of troublefree performance day after day, year after year.

That's why Olympic uses IOI fabric latexing machines.

Men who know fabric latexing will readily appreciate the rugged construction of every element in the IOI export unit shown above in operation at the Olympic plant—its tensioning control, its drying circuit, its fabric handling. Such construction is typical of IOI fabric latexers whether export units like the above or large high speed calender train systems handling fabrics 78 inches wide at speeds of 60 yards per minute and faster.

Heat at Work...in CONTINUOUS OPERATIONS

If you have a problem in this field it will pay you to consult IOI. We'll send detailed information or a sales engineer will call, as you prefer.

TIRE FABRIC LATEXING MACHINES • SPONGE RUBBER DRYERS • V BELT, CORD COATING SYSTEMS

FABRIC COATERS AND SYSTEMS • CONSTANT TENSION WINDUPS AND UNWIND MACHINES • CURING OVENS

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IOI ENGINEERING VERSATILITY

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ASSOCIATED COMPANY: JAMES DAY MACHINERY LTD., LONDON W.1, ENGLAND

Now A POLYMERIC PLASTICIZER AT A MONOMERIC PRICE—

PARAPLEX G-50

PARAPLEX G-50 now costs 39½c a pound* in quantity—actually less than most monomerics!

When PARAPLEX G-50 joined G-25 and G-40 as a polymeric plasticizer for vinyl compounds, it combined for the first time these great advantages: the permanent plasticizing effect and non-migratory characteristics that only a high-molecular-weight modifier can show, *plus* the simplicity of processing and ease of handling that once were exclusive properties of the monomeric plasticizers.

Now there's another important advantage — the new low cost of PARAPLEX G-50— that brings the qualities of this resinous plasticizer to the whole range of vinyl processing methods and vinyl applications: to extruding, calendering, molding, dispersion compounding, and to coated fabrics, electrical insulation, and both light and heavy weight film.

*F.O.B. PHILADELPHIA

If you have thought of PARAPLEX G-50 as a necessity in your high-cost, highest-quality vinyl production only . . .

If you have evaluated the permanence of PARAPLEX G-50, or its unequalled pigment-grinding ability, or its adaptability to dispersion compounding . . .

Or if you have only glanced wistfully at this plasticizer's freedom from odor or taste, or at its resistance to extraction, its processing ease, its non-migratibility . . .

Contact us immediately. Our technical staff will be glad to answer any questions you may wish to ask about your use of PARAPLEX G-50 — the polymeric plasticizer at a monomeric price.

PARAPLEX *is a trade-mark, Reg. U.S. Pat. Off.*

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ROHM & HAAS COMPANY

THE RESINOUS PRODUCTS DIVISION

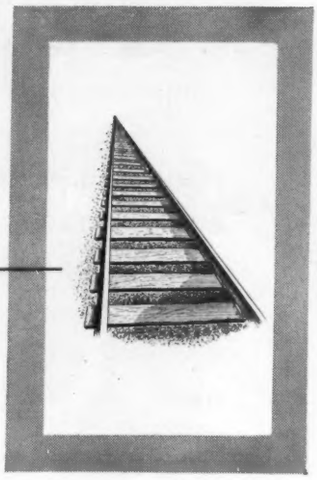
Washington Square, Philadelphia 5, Pa.

The Resinous Products Division was formerly The Resinous Products & Chemical Company

ALL YOU WANT IN STEARATES

QUALITY

For more than a quarter of a century, Witco Stearates have been noted for their high quality. And Witco's constant research and testing methods see to it that the high quality of these stearates will always continue.



UNIFORMITY

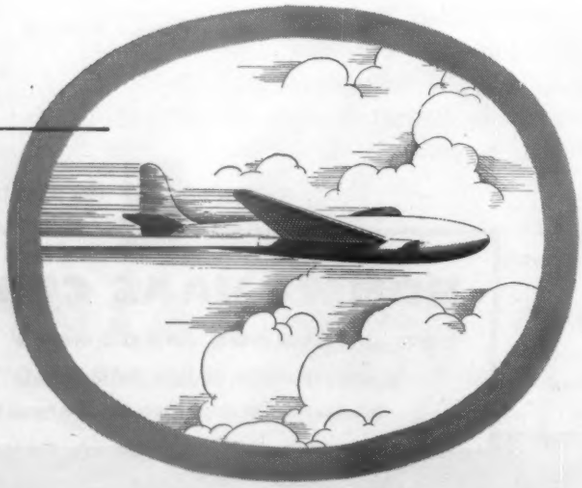
Witco Stearates have an enviable reputation for dependable uniformity and fine fluffy texture. These qualities are assured by careful technical control . . . from start of production to packaging.

FULL RANGE

Witco's line of quality stearates includes aluminum, barium, calcium, lead, lithium, magnesium, zinc—and others for special applications. *All* are in wide use throughout industry.

PROMPT DELIVERY

Ample supplies of Witco Stearates, produced at Witco's two plants, are stocked at convenient shipping points so that you get prompt delivery. Place your order today and *see*. Samples on request.



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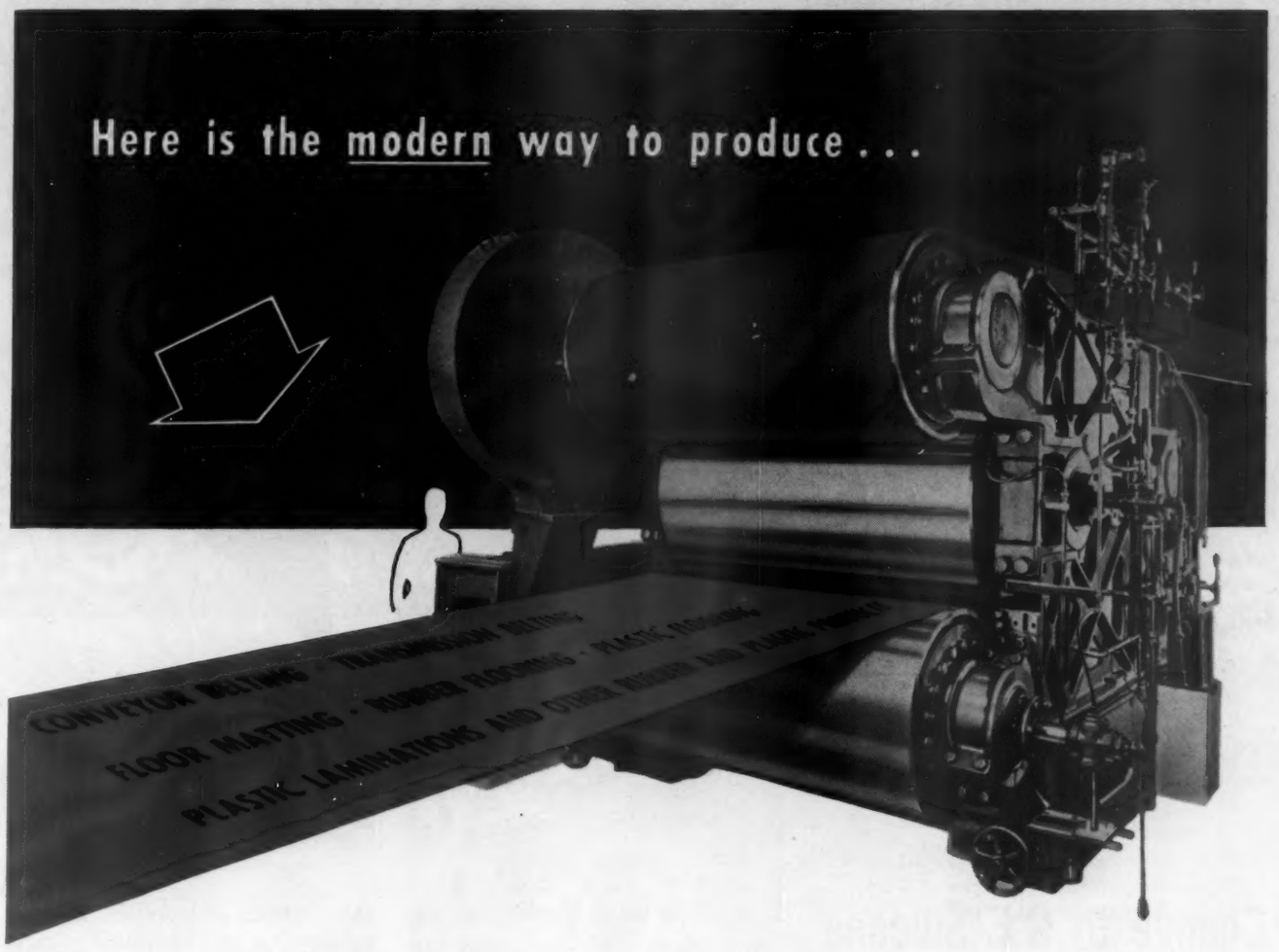

This machine, the ROTOCURE,* has a number of advantages where the run of any one size or type of materials is great enough. For example:

1 Continuous operation increases production by eliminating interruptions for opening, unloading, loading and closing.

2 Where material is cured in long lengths, double-cure around the overlap area, necking and non-uniform stretch are avoided.

3 Less floor space is required.

4 The work area can be kept cleaner and free from water which is common in belt press pits.

Cost comparisons indicate that where manufacturing conditions favor the use of the ROTOCURE, this machine, on some products, can save up to nearly 50 per cent of present production costs.

A Farrel-Birmingham engineer will be glad to discuss with you the possibilities of the machine for your particular conditions. A request for an appointment, or for further details by mail, will involve no obligation.

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Plants: Ansonia and Derby, Conn.; Buffalo, N. Y.
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FB-508

* The ROTOCURE is a patented machine built under license from Boston Woven Hose & Rubber Co.

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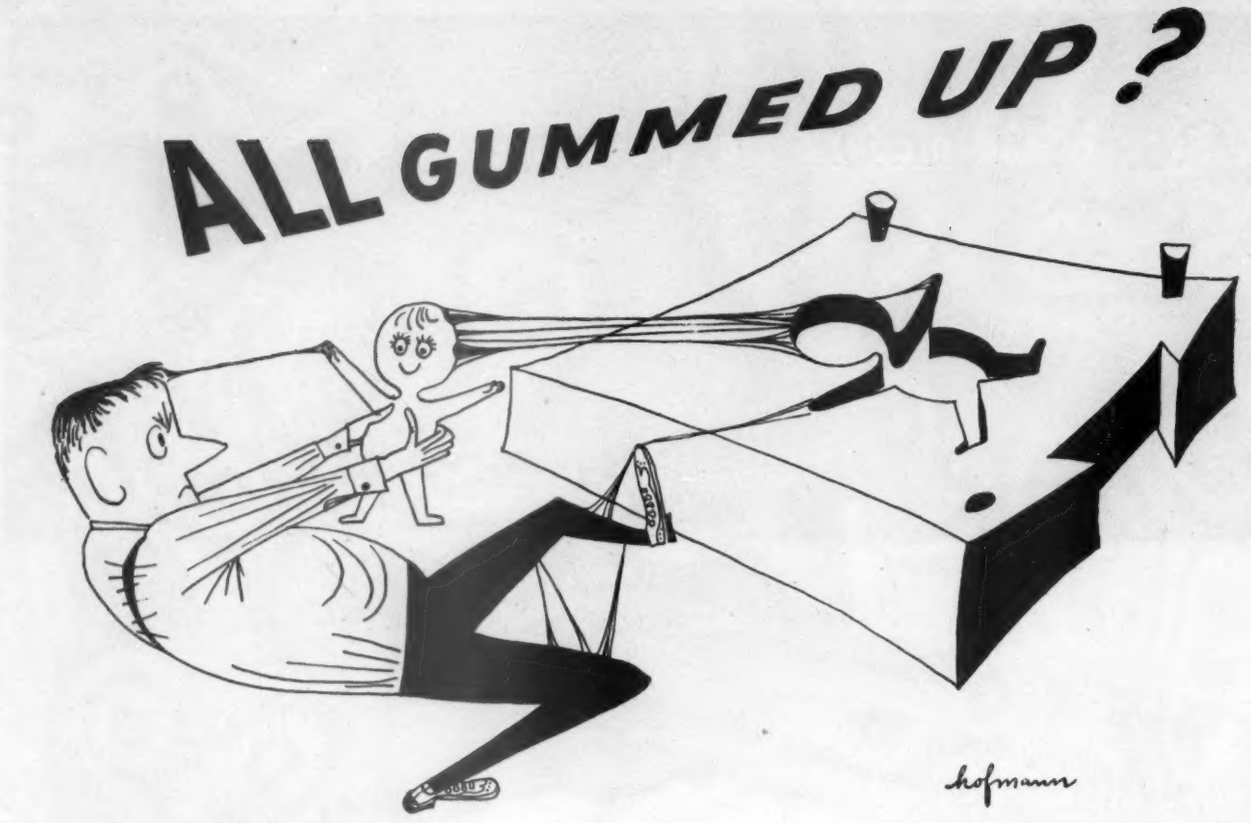


Change to G-E Silicone Mold Release Agents

There's no sticky deposit to gum up your molds when you use General Electric silicone mold lubricants! They save time, reduce rejects. These new oils and water-diluted emulsions have a low surface tension, easily wetting the surfaces and crevices of the molds. Thus their faster, smoother release shortens "down time," decreases damage and scratching of molded rubber parts. One application of General Electric silicone mold lubricant is effective through several molding cycles. The mold does not have to be cleaned after each cycle. And rubber molders tell us that in some instances, G-E silicone mold release agents help them to get a better flow of material into all parts of the molds.

For improved production, order General Electric silicone oil #9981 LTNV-70 (low viscosity), #81092 (high viscosity), silicone emulsion #81024 (75% silicone), or #81099 (35% silicone) in any quantity from pints to drums. Quick delivery. Write for additional details. Section 41-2, Chemical Department, General Electric Company, Pittsfield, Mass.

SILICONES for Industry

GENERAL ELECTRIC

CD49-R1

STABILITY . . . Marvinol VR-10 is superior in resistance to heat, light and other normally destructive factors.

VERSATILITY . . . Marvinol VR-10 is easy to process . . . may be calendered, extruded, injection molded, used in non-aqueous dispersions, formulated as unplasticized rigids . . . uniquely versatile.

TOUGHNESS . . . Marvinol's high molecular weight offers you extra toughness and "dryness" with long life . . . resists tear, wear, oils, acids.

. . . here's why industry is turning to MARVINOL® the unique VINYL RESIN

WIDER TEMPERATURE RANGE . . . Marvinol VR-10 assures you products that show less deformation due to heat . . . gives greater low temperature flexibility.

EASILY CLEANED . . . Marvinol-based products are easily and quickly cleaned because of their smooth surface. They're waterproofed, unaffected by mold or fungi.

The New Ultra-Modern Marvinol Plant contains the latest equipment to assure efficient operation, uniform production of the highest quality. Send today for details. Write on your company letterhead to Chemicals Division, Dept. R-2. The Glenn L. Martin Company, Baltimore 3, Maryland.

COLOR . . . Marvinol offers many opportunities for distinctive coloring . . . from clear to delicate or brilliant shades.

CLOSE COOPERATION . . . The Glenn L. Martin Co. compounds and fabricates only in its customer service laboratory for your benefit. We sell only raw materials. Our sales engineers and modern customer research laboratory are ready to help with your processing problems.

Martin Marvinol

RESINS, PLASTICIZERS AND STABILIZERS PRODUCED BY THE CHEMICALS DIVISION OF

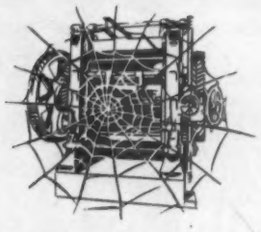
THE GLENN L. MARTIN COMPANY • AN INTERNATIONAL INSTITUTION

"BETTER PRODUCTS, GREATER PROGRESS, ARE MADE BY MARTIN"

How Much Are You Losing a Year Due To Inaccurate Calendering?

Do You Know That By Reducing The Running Tolerance of Rubber Coat Only One-half of One Thousandth of An Inch...

YOU CAN



The material wasted by inaccurate calendering on existing, out-moded equipment which requires, in many instances, tolerances exceeding five thousandths, represents probably one of the greatest items of loss in the Rubber Industry.

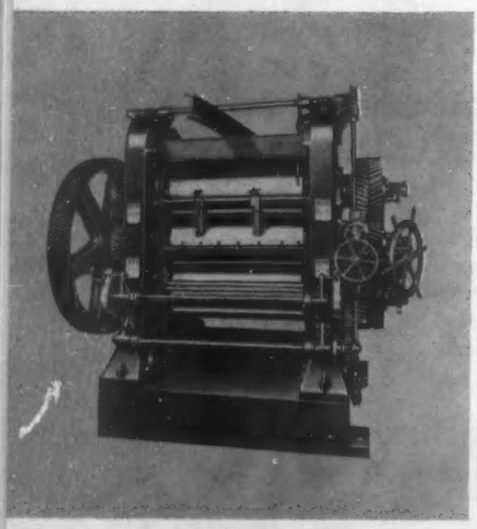
By reducing the running tolerance of rubber coat applied to both sides of carcass fabric by only *one-half of one thousandth of an inch,* a tire manufacturer can *save in material, more than $1.00 a minute,* or approximately $720.00 a day on each calender in operation in his plant.

This sounds like an exaggerated statement, yet

HERE ARE THE SIMPLE FACTS

• The usual width of fabric to be coated is.....	54"
	x 36
• Therefore the area of a lineal yd. (one side) is...	1944 sq. in.
	x 2
• Both sides.....	3888 sq. in.
• If, over this area, PRECISION CALENDERING CAN SAVE only one-half of one thousandth of an inch of rubber coat.....	x .0005
• THE SAVING PER RUNNING YARD WILL AMT. TO	1.944 CU. IN. OF STK.
• The approx. weight of 1.944 cu. in. of compounded stock is.....	.07 lbs.
• The average cost of stock at the calender is approx.	x 32¢ a lb.
• Therefore THE SAVING PER RUNNING YD. will be	2.2¢
• Figuring the average calender speed at.....	x 50 YPM.
• THE SAVING FOR ONE CALENDER WILL BE AT LEAST.....	$1.00 A MINUTE

$1.00 A MINUTE . . . $60.00 AN HOUR . . . $720.00 PER 12 HOUR DAY



COMPARISON OF

Typical Old Style Calender in Current Use

ROLLS:

. . . are chamber bored. Temperature differences between center and ends of roll face affect roll crown and contour.

ROLL BEARINGS:

. . . full bronze lined, arranged for grease or force feed oil lubrication. There are no seals at ends of box to prevent leakage of lubricant onto roll face. Sufficient running clearance must be allowed for operation of rolls at topmost temperatures.

ROLL CROWN:

Rolls are ground with proper contour to produce uniform gauge on most popular stock. Other stocks of different hardness and separating forces cannot be run at uniform gauge.

ROLL ADJUSTMENT:

Adjustment of all rolls is obtained through single hand wheel or motor. Top roll operates thru a screw that lifts top roll bearing boxes by means of a lifter plate.

GEARING:

Connecting gears, with cut double-helical teeth, are mounted on the rolls, together with bull gear and pinion which supply the power to the middle roll. These are enclosed in oil-tight, light metal gear guards so that bottom gears can dip in oil bath and carry lubricant to top gears.

ADAMSON UNITED COMPANY

AKRON 4, OHIO

SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY

SAVE MORE THAN $1.00 A MINUTE!

TO MEET PRECISION DEMANDS

. . . of the Plastics Industry, we undertook several years ago, the development of major improvements in calendering processes which resulted in the design of *entirely new Precision Units* capable of calendering to very low tolerances at high production speeds. These new Precision Calenders are producing uniformly accurate plastics film of various thicknesses ranging from extremely low gauges to heavier rigid sheets.

And now this same type of Precision Calender is available for use in the Rubber Industry where it will more than justify the replacement of present outdated, inefficient equipment *on the basis of only a 10% reduction in the waste of compounded rubber stock.*

Actually, a Precision Calender can effect savings in one year which will equal if not exceed the capital investment required to install it.

USE THIS CONVENIENT FORM TO FIGURE THE SAVINGS IN YOUR PLANT.

• Width of fabric to be calendered		inches
	x 36	
• Area of lineal yd. (one side)		sq. inches
	x 2	
• Area of both sides		sq. inches
• If PRECISION CALENDERING SAVES YOU only one-half of one thousandth of an inch of stock	x .0005	
• YOU WILL SAVE PER RUNNING YARD		CU. IN. OF STOCK
• Approx. weight 1 cu. inch compounded stock	x .036	lbs.
• Approx. weight of stock saved per running yard		lbs.
• Average cost of stock at your calender	x ____	¢ a lb.
• YOUR SAVING, PER RUNNING YARD		¢
• Your calender speed	x ____	YPM.
• YOUR SAVING FOR ONE CALENDER WILL BE	$	A MINUTE

$ . . . A MINUTE

$ . . . AN HOUR **$ . . . PER . . . HOUR DAY**

Naturally we'd welcome an opportunity to tell you more about the advantages of precision calendering and estimate the savings it could effect in your particular operation. Why not consult us . . . without obligation, of course.

SPECIFICATIONS

Adamson United New Precision Calender

ROLLS:

. . . are arranged for cooling and heating through longitudinal holes drilled near periphery of the roll. Uniform temperatures at center and ends of roll prevent uneven expansion and hold original contour.

ROLL BEARINGS:

Equipped with precision-type roller bearings adjusted to zero clearance, flood oil lubricated at controlled temperature. Close fitting seals effectively retain all lubricant, preventing stock contamination. Rolls are ground in own bearings to assure exact concentricity under operating conditions.

ROLL CROWN:

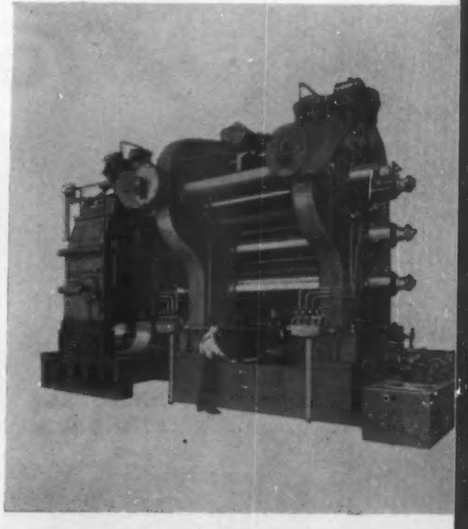
Adjustment for variable roll deflection obtained by crossing roll axes. Wide variety of stocks can be run with complete uniformity of gauge.

ROLL ADJUSTMENT:

Top roll stabilized by hydraulic push-back devices, which remove clearance from the screwdown mechanism. Leveling of individual rolls accomplished by push-button controls, located for operator's convenience.

GEARING:

Each roll is individually driven through a universal spindle, permitting crossing the roll axes to compensate for roll deflection. A separate pinion stand mounts the fine-pitch roll connecting gears in a rigid housing. Connecting gears run on fixed centers, and are oil flood lubricated.



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NEW YORK: 441 Lexington Avenue
CHICAGO: 140 South Clark Street
LOS ANGELES: 5140 Crenshaw Blvd.

PARIS: 5 bis Rue Massenet, Paris 16e.
INDIA: Ajupura, Post Anand, Bombay Province

Tough...flexible...decorative...

maybe it can give you ideas!

THE material you see above is braided wire. Here at National-Standard it is produced in almost limitless variations . . . flat, tubular, plain, beamed, springlike or untempered, tight or expanded, in many wire sizes, in a great many widths, and of any metal that can be drawn into wire.

At present, the most common uses are for reinforcing pneumatic tire beads, high pressure hose and other rubber products. In these applications its strength and mechanical adhesion qualities are unsurpassed.

Considering its limitless variations and unique qualities, braided wire is bound to have many other effective applications. Perhaps it can save or make money for you! An interesting possibility, for example, is its use with transparent plastics to produce pleasing patterns as well as reinforcement.

If all this gives you an idea you'd like to explore, be assured that National-Standard, as usual, is ready to cooperate with you all the way. Let's talk it over. Just get in touch with the *National-Standard Company, Niles, Michigan.*

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NATIONAL-STANDARD Company
NILES, MICHIGAN

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NATIONAL-STANDARD.. *Niles, Mich.*	Tire Wire, Fabricated Braids and Tape
WAGNER LITHO MACHINERY.. *Jersey City, N. J.*	Lithographing and Special Machinery
WORCESTER WIRE WORKS.. *Worcester, Mass.*	Round Steel Wire, Small Sizes

New ALBALITH-73

(LITHOPONE)

BEST for ALL Types of Rubber Compounds

Send for Samples

HORSE HEAD PRODUCTS

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 7, N. Y.

CRYSTEX
INSOLUBLE SULPHUR

for maximum control of *Sulphur-Blooming*

OTHER RUBBERMAKERS' CHEMICALS

Commercial Rubbermakers' Sulphur, Tire Brand, 99½% Pure

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Refined Rubbermakers' Sulphur, Tube Brand

•

"Conditioned" Rubbermakers' Sulphur

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Carbon Tetrachloride

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Carbon Bisulphide

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Caustic Soda

•

Sulphur Chloride

Stauffer CHEMICALS
SINCE 1885

CRYSTEX INSOLUBLE SULPHUR OFFERS FLEXIBILITY. Being 99½% pure, with an 85% insoluble sulphur content, it is used straight for maximum control of sulphur-blooming. However, in some particular rubber stocks, the desired results can be obtained with a lower insoluble sulphur content. Blending CRYSTEX with Flowers of Sulphur (which normally tests 30% insoluble sulphur) is an economical and convenient method to lower the insoluble sulphur content.

If you have not in recent months checked the feasibility of using CRYSTEX in your operations, we suggest you do so, as the price of this Insoluble Sulphur is lower today than at any time.

Write today for CRYSTEX literature and prices.

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View of elevators and storage for bag packing in one of our furnace units at Ryus, Kansas.

Why, Of Course!

A number of your compounds would be better if they contained more Dixie 20, the semi-reinforcing (SRF) furnace black, and, furthermore, you would have an added advantage in processing. Therefore, for maximum efficiency use Dixie 20 in more of your compounds.

Standardize on United carbon blacks. Their uniformity and high quality will contribute to the excellence of your products.

DIXIE 20

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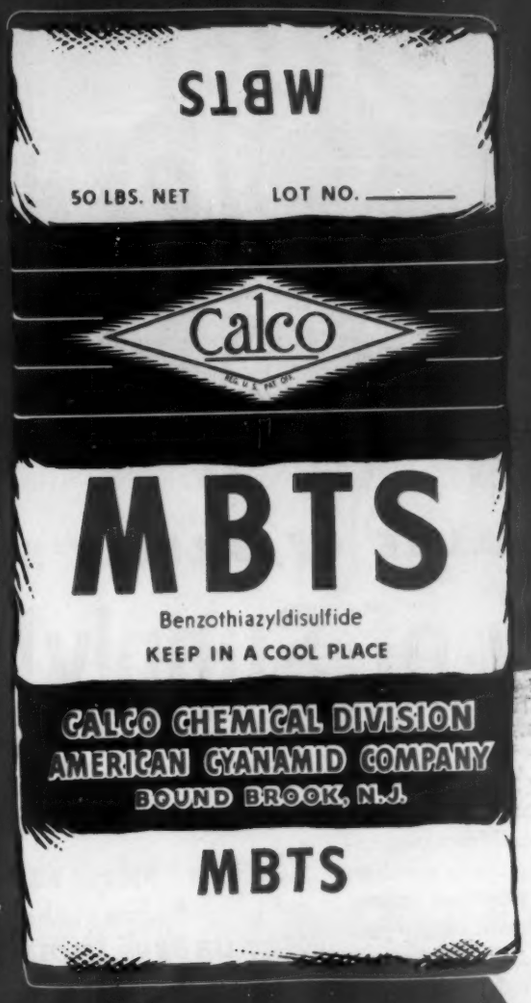

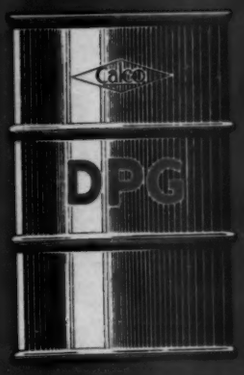

= low-cost acceleration ...good physical properties

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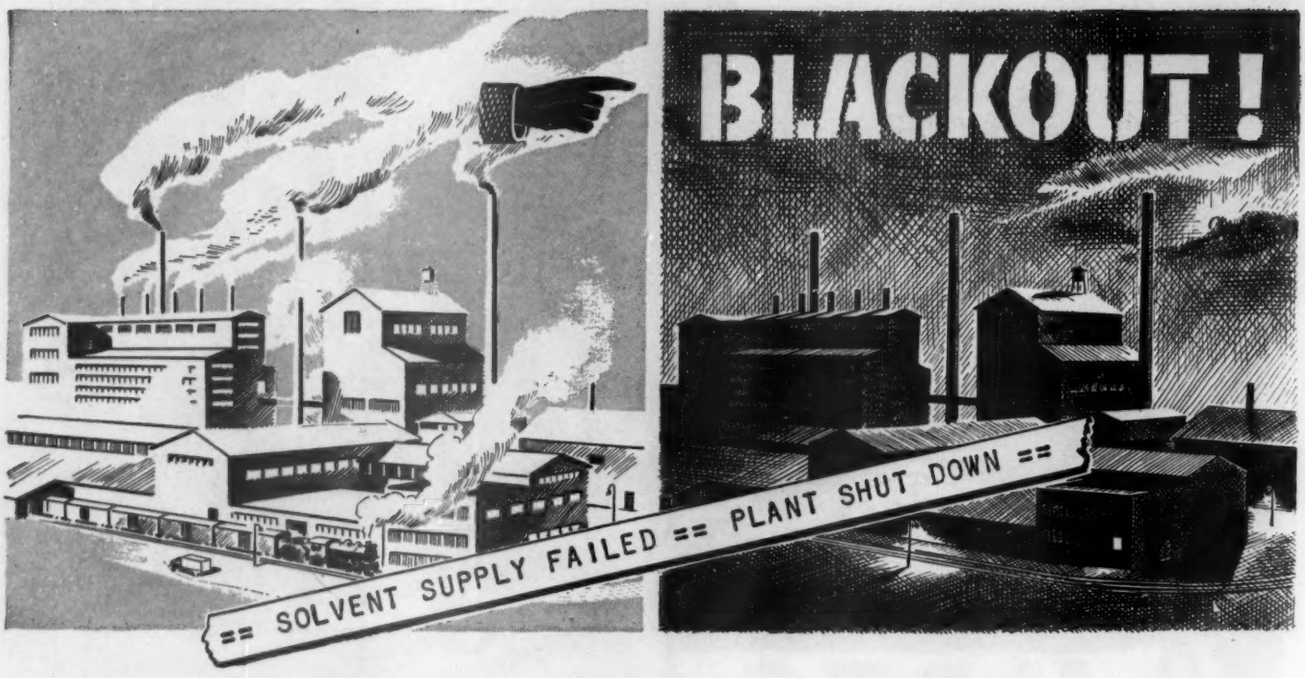


A LESSON ON THE VALUE OF SKELLY'S

Dependability of Supply!

"DOC" MacGEE SAYS: Maybe the possibility of a delivery failure in your solvent supply . . . due to some unforeseen shortage . . . seems remote to you. Perhaps such a solvent shortage has never caused a temporary shutdown in any department of your plant. But the mere fact that the possibility does exist, and that shutdowns of this nature do occur, makes *extra precaution* only sensible. That is why so many solvent users have come to place a high value upon Skellysolve's *dependability of supply*.

Other things are important, too, of course. Purity, uniformity, close boiling ranges, freedom from foreign tastes and odors . . . all these we guard with unceasing vigilance.

Skellysolve's *dependability of supply*, however, is something else. We are proud of our record in supplying various types of special fractions, unfailingly, without regard to weather, season, or rush of previous orders. We have our own facilities for producing, purifying, fractionating, handling, storing, and transporting extra quality naphthas that are unsurpassed in the field. Solvents are our *business*. We have pioneered many of the developments in the field of special naphthas. And we are in the business to stay!

So, if some failure of your solvent supply would be a serious matter in your plant, we suggest that you give Skellysolve a trial. We're sure that, whether you judge your solvent on quality of product, promptness of service, or dependability of supply, you'll be *satisfied* with Skellysolve!

How SKELLYSOLVE Serves the RUBBER INDUSTRY

There are six different types of Skellysolve especially adapted to various uses in this industry, for making rubber cements and for many different rubber fabricating operations. Skellysolve offers many advantages over benzol, rubber solvent gasoline, toluol, carbon tetrachloride, etc. Our Skellysolve Technical Fieldmen have aided many manufacturers in developing formulas for new or improved products, and in "shooting" solvent troubles. Write today for full information.

SKELLY

Skellysolve

SOLVENTS DIVISION, SKELLY OIL COMPANY, KANSAS CITY, MO.

ANNOUNCING

CABOT'S
HAF
CARBON
BLACK

Vulcan-3

AVAILABLE NOW IN CARLOADS

- *Fine Particle Size*
- *Superior Reinforcement*
- *Excellent Abrasion Resistance*

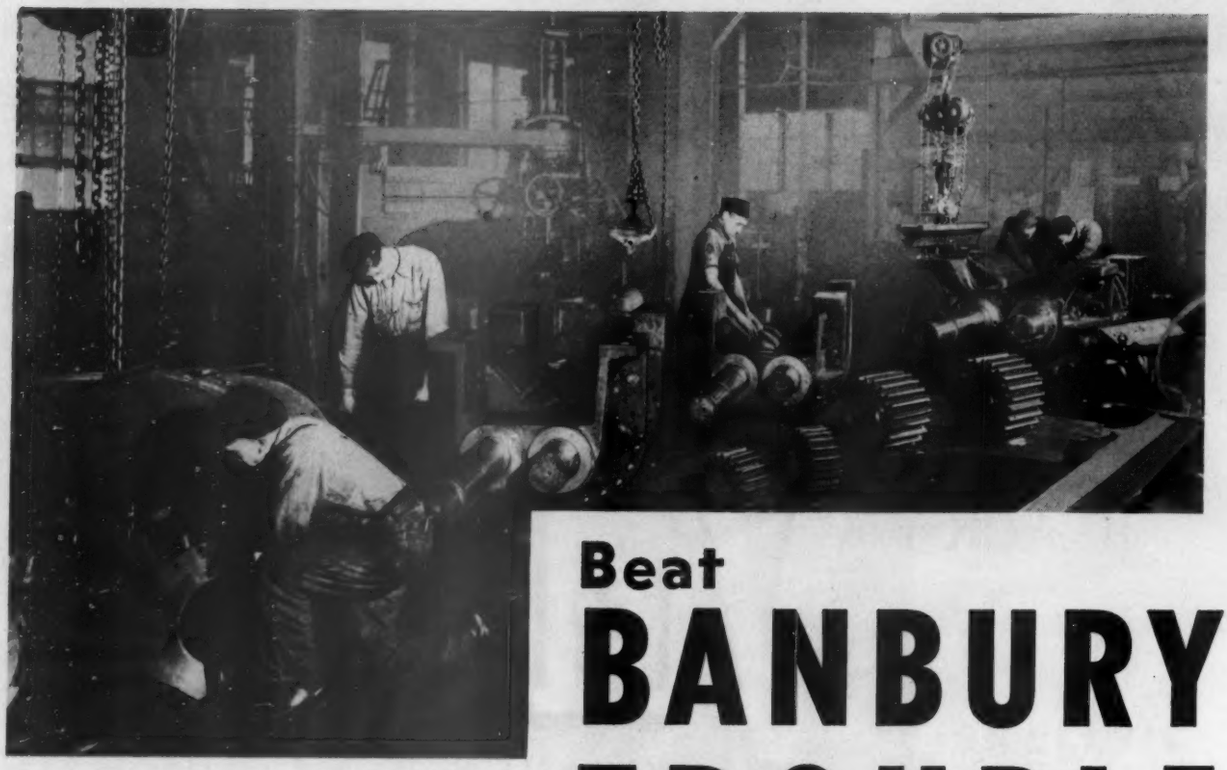
This outstanding new High Abrasion Furnace black is now available in carloads, and is particularly recommended for use in best quality treads and low-temperature rubber.

Laboratory Tested – Factory Tested – Road Tested

CABOT

GODFREY L. CABOT, INC.

77 FRANKLIN STREET, BOSTON 10, MASSACHUSETTS



Beat BANBURY TROUBLE To The Punch

Many Rubber Plants have entrusted all Banbury body rebuilding to us for years — some ever since we started business 15 years ago.

Interstate-rebuilt Banburys are performing with full satisfaction in plants all over the United States, and in foreign countries, too.

To every Banbury mixer in steady use the time comes when the harsh wear and grind causes badly worn parts. That means trouble.

But it no longer need cause many weeks of lost production time for rebuilding. Not if you act now.

We guarantee our "Pre-Plan" Banbury rebuilding service will reduce "down-time" more than half.

And we know how to rebuild your Banbury body to give highest mixing efficiency over *longer* periods of sustained operation. We guarantee that, too.

Here is the service you want—the service that beats Banbury troubles to the punch. So why wait?

Save yourself lost time and money later on by calling us NOW for full details.

SERVING THE IWS RUBBER INDUSTRY

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Main Plant: 914 Miami Street . . . AKRON 11, OHIO . . . Phone: JE 7970

EXCLUSIVE SPECIALISTS IN BANBURY MIXER REBUILDING

THE
ONE AND ONLY
SUPPLIER OF

PARA-FLUX®

® Registered Trade Mark of the C. P. Hall Co.

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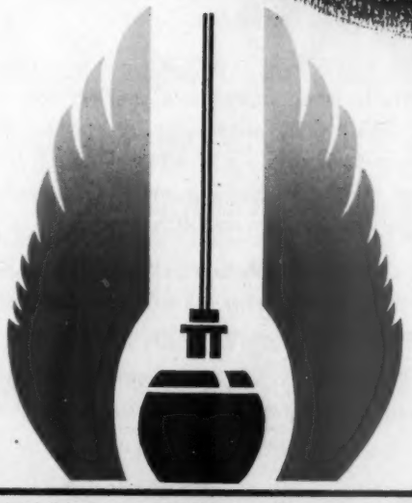

Since 1925 The C. P. Hall Co. has supplied the rubber industry with PARA-FLUX.® Many substitutes have appeared on the market since that time, but PARA-FLUX® continues to be the standard softener and plasticizer for the rubber industry.

The C. P. Hall Co.
CHEMICAL MANUFACTURERS

AKRON, OHIO
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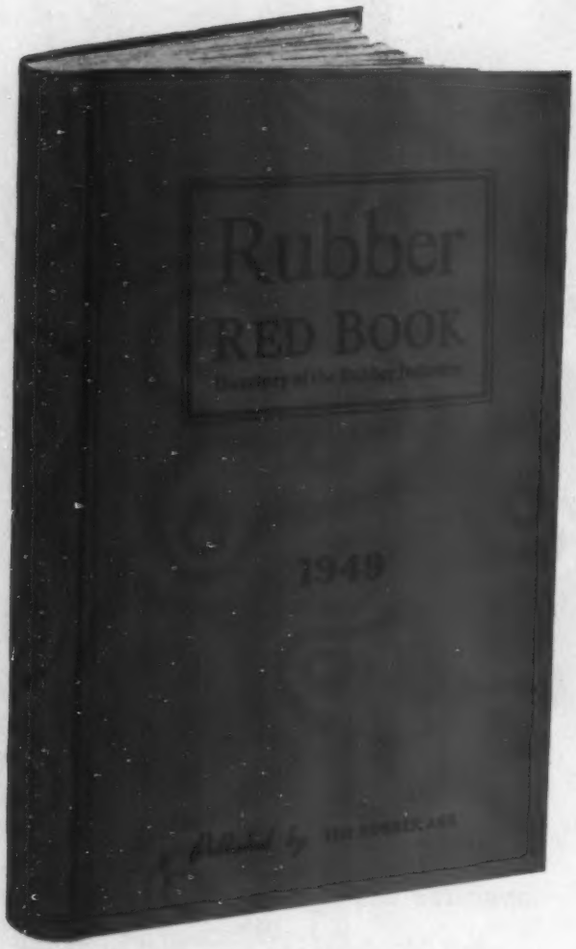
A Reminder to Order Space in the 1949 RUBBER RED BOOK!



The Seventh issue of the RUBBER RED BOOK —the 1949 Edition—will be published in June, 1949.

. . . And once again indications are that this issue will surpass all previous editions in completeness as well as in advertising volume.

Each edition of this Directory has contained improvements over previous issues—many of the changes having been suggested by rubber manufacturers themselves. As a result, the last edition (1947) was a volume of 840 pages compared with 372 pages in the first issue in 1937.

Probably no other book receives as much day-to-day use as the RUBBER RED BOOK. Well-thumbed copies on the desks of purchasing agents, chemists, factory managers and others in the rubber industry attest to the frequency with which this Directory is consulted to obtain answers to the many questions that arise in daily plant operation.

That's why the number of advertisers has grown from 100 in the first edition to 275 in the last—why already almost 100 advertisers have reserved space in the 1949 edition, although the only announcement made was a small circular distributed in December.

In the RUBBER RED BOOK your advertisement is available for study when buyers are seeking new sources of supply. The data in your advertisement may be the deciding factor in your favor . . . it's just like having your salesman right there at the opportune moment! Nowhere else can you possibly accomplish so much at such a low cost.

The condensed schedule of rates shown in the box at the left must lead you to ask whether you can afford **not** to use appropriate space in the forthcoming edition.

Closing date for copy is April 1 but we suggest you send in your reservation now and follow it up with copy later.

1949 EDITION

Condensed Schedule of Rates

1 page	$130.	2 pages, ea.	$125.
½ page	70.	2 half pages, ea.	68.
¼ page	40.	2 ¼ pages, ea.	39.
Colors, Red	extra		50.
Other Colors	extra		75.
Bleed Pages	extra		20%

Inserts—Not accepted

For complete rates and sizes write for 1949 rate card.

Published by

RUBBER AGE

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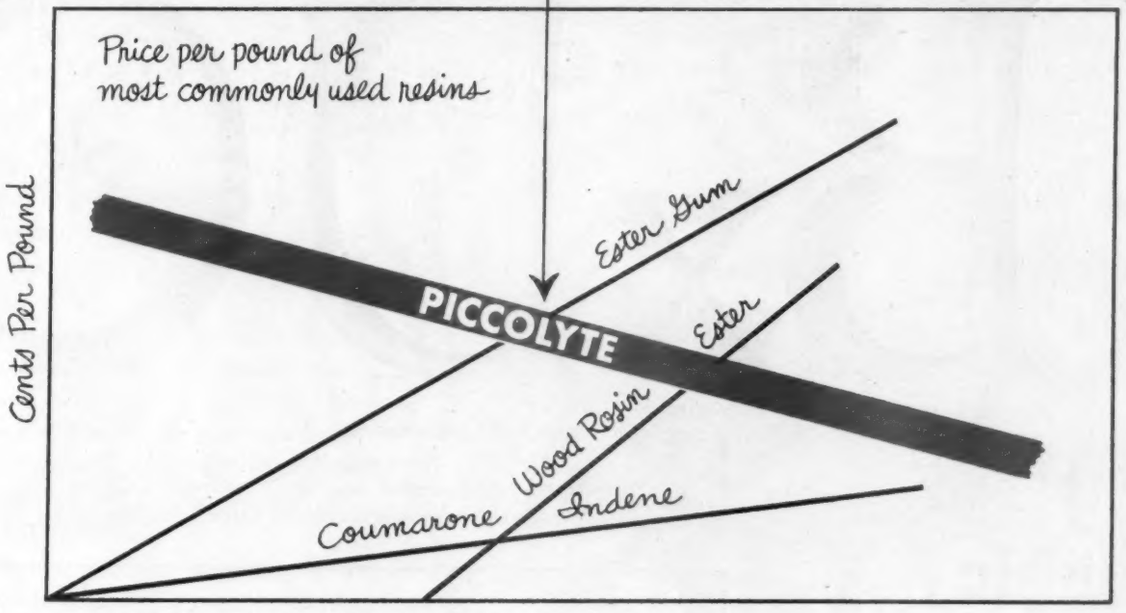
Piccolyte

the Versatile Resin

costs less today than ever before

If you require a light colored, low molecular weight softener of hydrocarbon nature . . . investigate PICCOLYTE!



Ideal for EXTENDING, TACKIFYING, CEMENTING

ECONOMICAL. In addition to its low cost per pound, Piccolyte is soluble in low-cost naphthas in all proportions (an important additional source of savings)—as well as in many other solvents.

PALE COLOR, NON-YELLOWING. These very pale, pure hydrocarbon products do not become yellow, but retain their pale color.

PROPERTIES. Piccolyte is a thermoplastic terpene resin, compatible with plantation rubber, many synthetic types including polybutene, and other compounding materials. It is stable, neutral, inert, free from toxicity. Made in nine melting points, from 10° to 125° C. Precision manufacturing control assures dependable uniformity of quality.

Write for free sample of Piccolyte, and complete details, given in the new bulletin. Use the coupon.

PENNSYLVANIA
INDUSTRIAL CHEMICAL CORP.
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Pennsylvania Industrial Chemical Corp.
Clairton, Pennsylvania

Please send me a free sample of Piccolyte, and your new bulletin. I wish to investigate Piccolyte for (application) .....

Name .....

Company .....

Address .....

(RA)

significant data

on the use

of

BxDC*

(BUTOXYETHYL DIGLYCOL CARBONATE)

as a

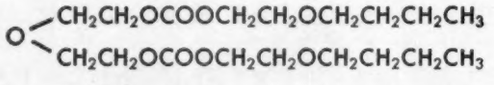
plasticizer

This new material has excellent properties as a plasticizer in typical vinyl resins and as a low temperature plasticizer for butadiene-acrylonitrile copolymers. It is also useful as a lubricant in Butyl rubber stocks compounded with the Columbia pigment Silene EF, or other non-carbon pigments. In this case, the addition of one to three parts BxDC per 100 of Butyl rubber appears to overcome the tendency of these stocks to adhere tightly to mixing or sheeting mills at processing temperatures in factory practice.

SEND FOR FREE BULLETIN—Properties of BxDC and data assembled on the performance of this plasticizer in a variety of applications are furnished in a newly published bulletin. Just write, requesting Columbia Plasticizer Data Sheet No. 48-2.

***GENERAL CHARACTERISTICS OF BxDC**

[Diethylene Glycol Bis (2-n-Butoxyethyl Carbonate)]



Butoxyethyl Diglycol Carbonate is a new, colorless, liquid organic plasticizer. It is substantially insoluble in water and is very stable to hydrolysis by water. Only neutral products and carbon dioxide can be formed upon hydrolysis. It is soluble in a wide range of organic solvents and is further characterized by excellent resin compatibility, low volatility and high plasticizing efficiency.

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• Research put a lot of answers in this barrel. Probably some for questions you've been asking. Questions that mean money to you.

Are you compounding a custom-builtadhesive?Cement?Combining Compound? Laminant? Impregnant? Sizing? Coating?

Need a product to meet specialized requirements? Or one suitable for reformulation?

Need a gallon? Need a tankcar?

Get in touch with us. Chances are we have just what you need. If not, our research and development staff will work right along with you to help you "cash in on this barrel-head". *T.M. Reg. U.S. Pat. Off.

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30 Rockefeller Plaza, New York 20, N.Y.

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FLINTKOTE *Products for Industry*

HARRISONS & CROSFIELD, LTD.*

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as

Exclusive Sales Representative

in the United States

for the Sale of Natural Rubber Latex

prepared by

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*The century-old British firm, Harrisons & Crosfield, Ltd., is a pioneer in the development of plantation rubber in Malaya, Ceylon, Burma, South India, Borneo, and the Netherlands East Indies. It has grown to pre-eminence throughout the world.

The plantations they manage have always been noted for the careful preparation of their product and the H. & C. mark has long enjoyed a world-wide reputation for reliability. The establishment of H. & C. Latex Ltd. with the most up-to-date equipment, under the supervision of a staff of experienced rubber chemists and engineers, should therefore be welcomed by all users of Natural Rubber Latex, who can be assured of a high quality and uniform product.

Centrifuged and Normal Latex of high quality can be supplied promptly in tank cars and smaller quantities at competitive prices.

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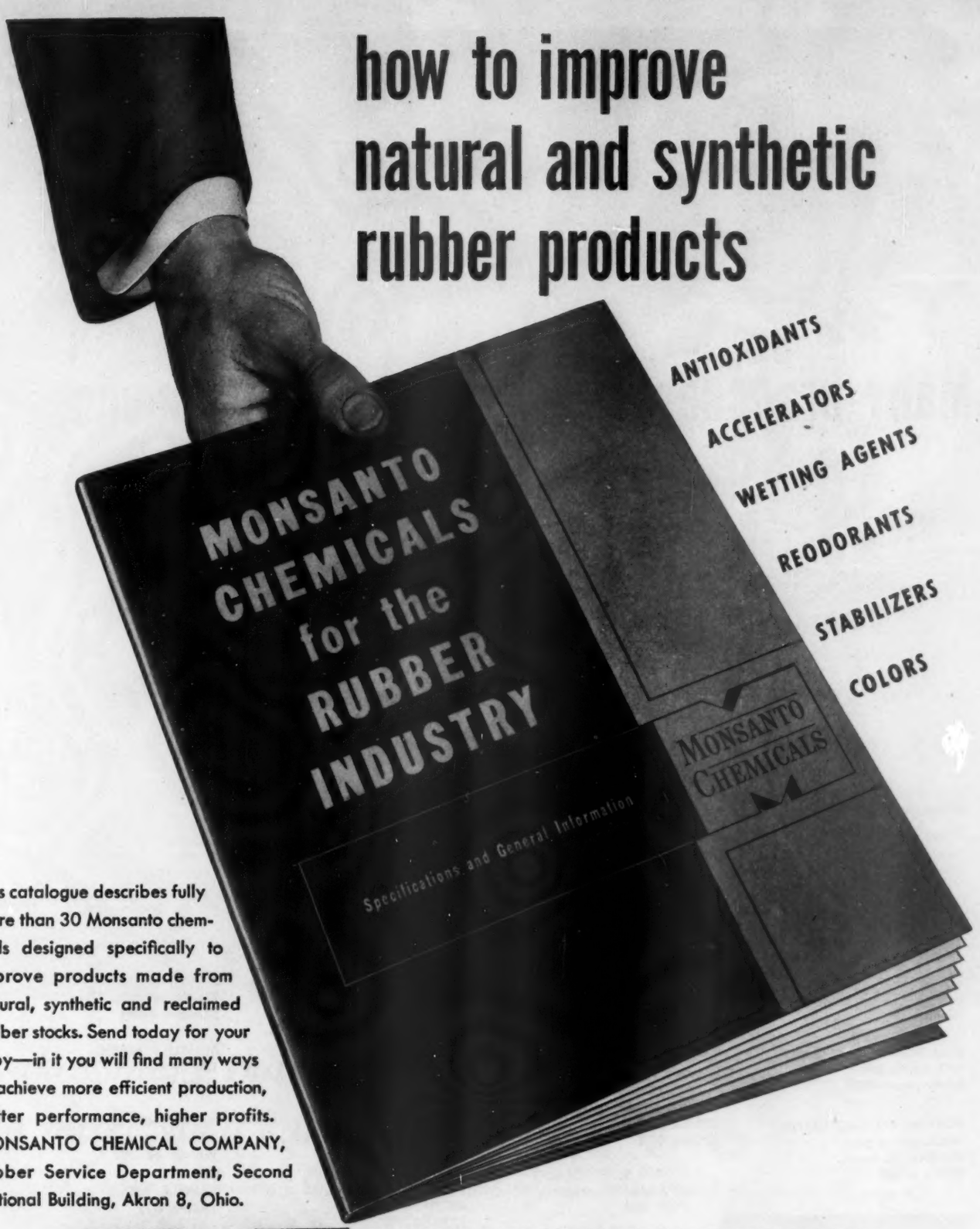
how to improve natural and synthetic rubber products



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This catalogue describes fully more than 30 Monsanto chemicals designed specifically to improve products made from natural, synthetic and reclaimed rubber stocks. Send today for your copy—in it you will find many ways to achieve more efficient production, better performance, higher profits. MONSANTO CHEMICAL COMPANY, Rubber Service Department, Second National Building, Akron 8, Ohio.

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CHEMICALS AND PLASTICS

MONSANTO CHEMICAL COMPANY
Rubber Service Department
Second National Building, Akron 8, Ohio

Please send me a copy of "Monsanto Chemicals for the Rubber Industry."

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Company_____

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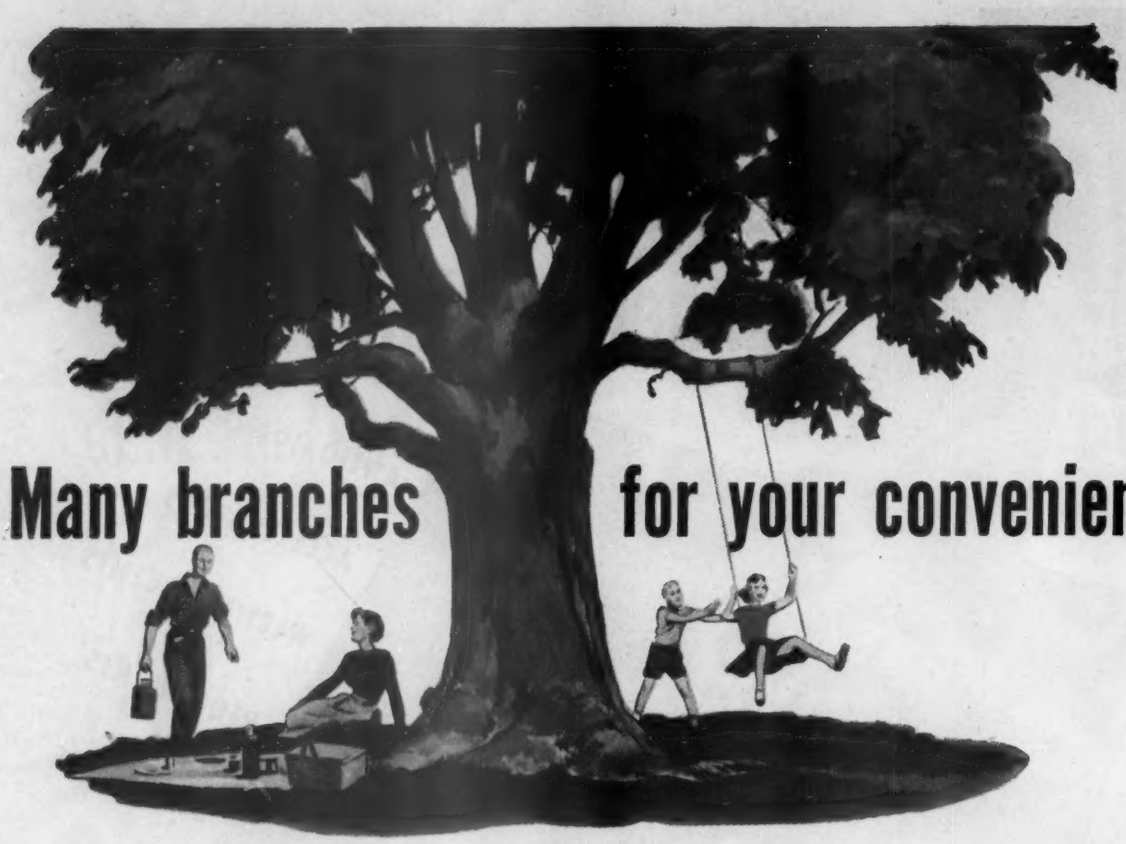

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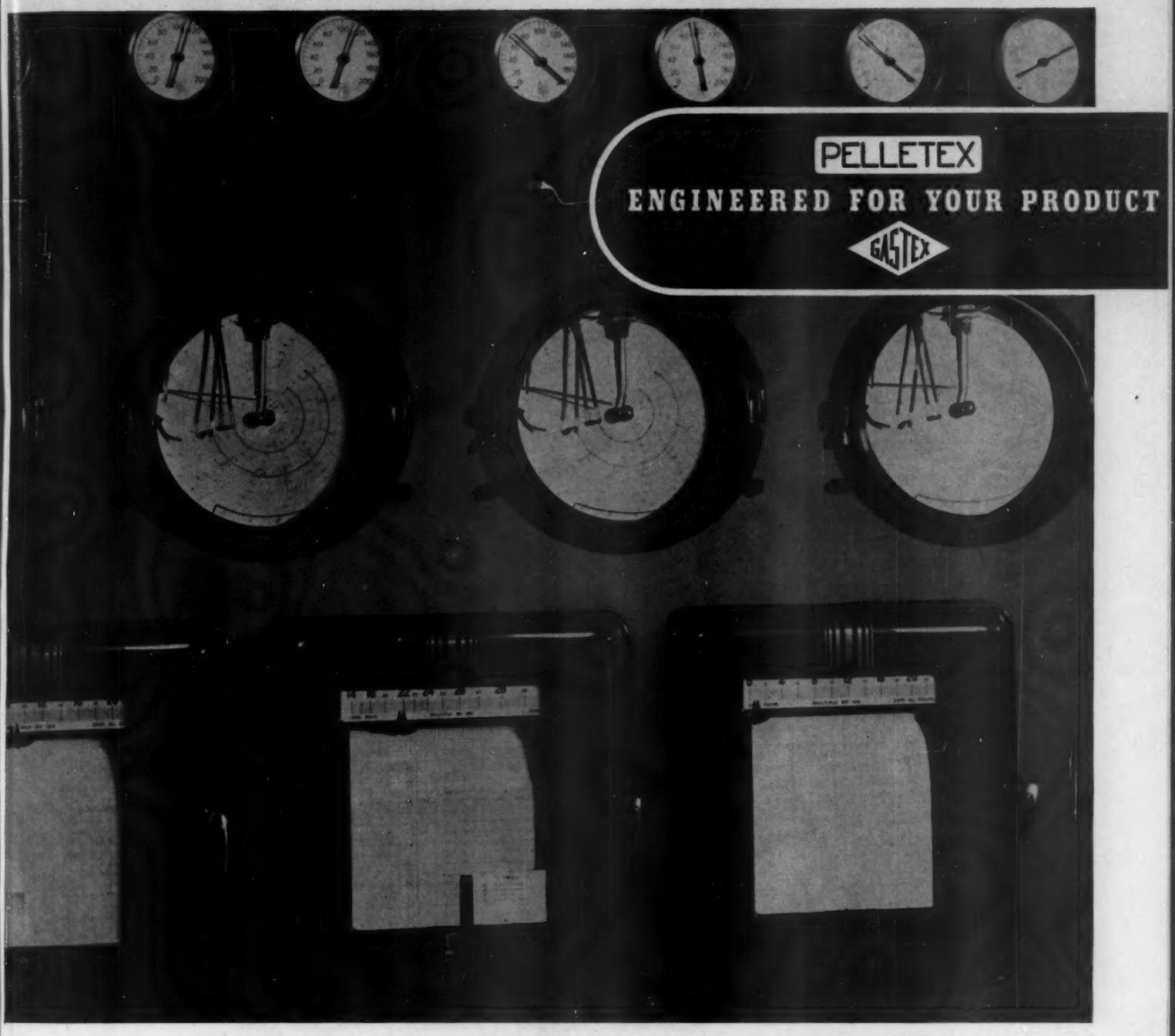

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